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MR. NEWBIGGING'S ADDRESS.

In another column will be found a most excellent address delivered by Mr. Thos. Newbigging, M.I.C.E., before the Manchester Institution of Gas Managers.

We have been most kindly furnished with an advance copy of this address by the author, and it gives us great pleasure to lay it before our readers, who will, no doubt, find much practical wisdom in it, and many suggestions that will be of value. There is one point touched upon very clearly and distinctly, viz.: The preparation of papers for the meetings of these Associations; and we commend what he says to every member of each of our organizations. The benefit to the writer is clearly well worth the effort, to say nothing of the good resulting to others from a short, distinct statement of facts and personal experience.

BURNERS.

At the present time there is no question which is of more prominent interest than the amount of light that can be developed from gas. With all the promises as to what is about to be done with other sources of illumination, there is yet associated the idea of futurity. This idea enters to so large an extent as to render the temporary and empirical results that have been reached extremely problematical when brought to the test of constant practical application. But far different is the result when we take up the consideration of the subject of improved means of burning gas. In a general sense increased light means increased quantity of gas consumed, and, hence, additional cost. But this is not the case to so great an extent as would at first appear, for the amount of light obtained increases much more rapidly than the amount of gas consumed.

Were it possible to obtain absolutely perfect combustion, the light given should vary as the square of the gas consumed; but perfect combustion has not yet been absolutely obtained, although rapid progress is being made in that direction, and there is no point to which we would to-day urge closer attention than to the discovery of better methods of consuming the gas on which so much skill and labor is expended in making.

As an example of the results that can be arrived at, we would say that the results from the Sugg double and triple ring burners show the increase of light to be as the 1·3 power of the gas consumed.

At some recent experiments, made in this city, the following facts were developed. The gas used was the same for all the burners tested, and the consumption was adjusted, as nearly as possible, to five feet per hour. By the old fifteen-holed Argand burner, the gas was shown to be 17·5 candles; with one burner the light from the flat flame was eleven candles; with another, about 13; with another, 22. The latter result was very surprising; but, nevertheless, that was the indication on the photometer.

Here was doubtless a very happy adjustment of all the items entering into the problem, such as pressure, temperature, size of openings, and the direction of the currents of gas.

Gas makers may take a very practical lesson from the oil men in regard to improved burners; and if they would overcome their competition they must at least secure as perfect a burner for gas as they do for oil.

OFFICE AMERICAN GAS LIGHT ASSOCIATION,
150 BROADWAY, NEW YORK CITY, March 11, 1878.

Members of the Association who have read Papers before the last two meetings, or who have participated in the discussions of the Association at those meetings, are respectfully requested to examine their papers, and the reports of the part taken by them in those Meetings, as published in the AMERICAN GAS-LIGHT JOURNAL, and if they deem any corrections desirable to report the same to the undersigned, on or before the first of April, prox.

CHARLES NETTLETON, } of Committe to Print
WM. HENRY WHITE, } Proceedings.

OIL GAS ASSOCIATION.

The Second Annual Meeting of this Association will be held at Middletown, Ohio, on Wednesday, May 14th, and it is hoped there will be a large attendance. All those interested in the use of oil or naphtha for gas making, whether members or not, are respectfully requested to contribute either by being personally present, and taking part in the discussions, or by sending papers embodying facts that will be of service to all concerned.

SHELBYVILLE, IND., March 10, 1879. } G. W. F. KIRK, *Secretary.*

Manchester District Institution of Gas Engineers.

ADDRESS OF THOS. NEWBIGGING, C.E., PREST.

The ninth annual and thirty-seventh quarterly meeting of the members of this Institution was held on Saturday, the 22d of February, at the Mitre Hotel, Manchester, Mr. Thomas Newbigging, M. I. C. E., of Manchester, President of the Institution, in the chair. The attendance was large, and several new members were enrolled. At the conclusion of the introductory business the President delivered the following

INAUGURAL ADDRESS.

GENTLEMEN:—In occupying for the first time the honorable position to which you have elected me, I desire to congratulate you on the prosperous condition of the Association. Our meetings are necessarily of an interesting and instructive character, due to the large number of members who take an active interest in the proceedings. It will be my earnest endeavor during my term of office to maintain and, if possible, increase their usefulness, and with your willing assistance there need, I think, be no fear as to the result.

Our object in periodically meeting together is twofold. We meet for social intercourse; but, primarily, that by the interchange of experiences and opinions we may enlarge our knowledge of the profession to which we all belong.

To meet occasionally for social enjoyment is not an unworthy purpose. In performing the responsible duties that devolve upon us we have difficulties to encounter, in overcoming which the watchful vigilance that is required of us throughout the twenty-four hours of each recurring day puts a strain upon the mental and bodily faculties that calls for occasional intervals of relaxation. Hence, to associate with those who have passed through experiences similar to our own, to exchange the friendly greeting and the cordial shake of the hand, affords a healthy stimulus to both body and mind and braces us to perform more efficiently the duties that lie before us.

But the chief purpose of our meetings is, as I have said, to extend the domain of our professional knowledge. The experience of isolated individuals, however extensive, is too limited in its range to embrace within it more than a very few of the elements which go to make up perfection. We come together, we read our papers, we express our ideas, we contribute our quota of experience to the discussion, and gradually something tangible is built up before our mental vision. It is like the child's puzzle, composed of numberless disjointed pieces, each representing but little in itself, but by dint of patient labor, and comparing one fragment with another, rejecting this for the time being, and selecting that, difficult at first, but sensibly becoming easier. the process of dovetailing the pieces together goes on, till gradually the completed picture is evolved from chaos.

I do not mean to imply that any one subject with which we deal, either is or can be threshed out and digested at a sitting or a dozen sittings. Nothing of the kind. Some of us probably go away confused and harassed with the variety of opinions we have heard expressed, and feeling that we know less of the subject then than we previously thought we did. If that be so, it may generally be set down as a desirable frame of mind. Our little imperfect crotchets that we have nursed and coddled have been blown to the winds; our range of vision has been extended. We have got food for reflection, and as we ponder the matter over in our mind, by the light thrown upon it by the varied experience of others we begin at length to feel that we have gained a clearer insight into the subject, and have advanced a step nearer to the solution of the mystery.

In this way we grow in knowledge, and are better servants of our employers. We begin to realize that we are more fitted to give an opinion on the matters under discussion; not dogmatically expressing our views—for there is no more certain cure for dogmatism than rubbing against our fellows—but with the wise diffidence which arises from widened experience and more matured judgment.

The present winter has severely tried the capabilities of gas works, their workmen, and responsible managers, throughout the district, and it may be recorded with feelings of pride that in no single instance have they been found wanting.

During the fog that has prevailed for days, I might say for weeks, together, the sun has been literally nowhere; and our streets, shops, and other places of business and resort would have been in a sad plight without the grateful presence and warmth of the gas flame.

Whilst the value of gas light grew in appreciation as the winter advanced, the opposite effect appears to have attended its threatened rival the electric light. The hopes that by many were entertained of its speedy and successful application have grown small by degrees. The limited experience we have had of electricity as a lighting agent has convinced all who have given attention to the subject, that vast improvements must yet take place, both in the means of generating and distributing the current before it can have the barest chance of supplanting the present system of illumination.

I have never wavered for one moment in the opinion which I hold that the continued future use of coal gas is assured; and that it will be co-equal in permanency with the duration of the supply of the material from which it is derived. There are other sources of artificial light, besides electricity, that are equal if not superior to coal gas in some respects; but the trouble, and inconvenience, and expense attending their employment prevent their coming into competition with it so far as to affect its general use.

But if we consider for a moment we shall arrive at the conclusion that no vast industry was ever in any past time, or in any country, swamped in a day or in a year. I will go further and say that no great industry of which the world was proud ever has become extinguished at all. Even in things that are from necessity destined to change, the change, whilst inevitable, comes by slow degrees. Gas proprietors may take heart of grace whilst they wish all success to scientific discovery and improvement.

My own opinion, in respect to electricity, is, further, that unless the fluid, after its generation, can be stored in a manner similar to coal gas, or by some other method of accumulation, so that there shall always be a surplus stock in case of temporary failure of the generating machine, or its motive power, from any cause, and such stock be capable of distribution—I say unless this is accomplished I believe that even its comparatively extensive use as an illuminating agent is not practicable. I leave out of consideration altogether, as being entirely secondary, the possibility of the unlimited subdivision of the current, and the question of cost or suitability in other respects. It is this very circumstance of storage that has contributed more than anything else to the successful and world wide employment of coal gas, for, without the reservoir to equalize its distribution, and ensure an unbroken continuity of supply, gas would have proved a certain failure for lighting and the other purposes to which it is applied.

It is an instructive fact that Winsor, in his earlier experiments tried to dispense with the holder, supplying the gas from the retort as it was generated, and found it impracticable to do so. Again, in the Application to Parliament, in 1809, of the "National Light and Heat Company," for a charter of incorporation, whilst all the other principal apparatus of a gas work were enumerated in the estimate of cost that accompanied the Bill, the gasholders were omitted—not from oversight, for Accum in his evidence, when replying to an allusion that had been made to the danger which might arise from an accumulation of gas, distinctly said: "If there is no reservoir the gas cannot accumulate—there is no reservoir in Mr. Winsor's plan; the pipes contain the gas without reservoir." The defeat of the projected company on the occasion referred to, was principally due to the evidence given on behalf of the opposition, by James Watt, Jr., son of the great inventor, or improver of the steam engine. He dwelt strongly on the absolute necessity of storing the gas in holders, so that the accumulated stock might be ready to be employed whenever desired, and that there might be no failure in the lighting.

I see no reason whatever for believing that electricity has an advantage in this respect over gas, or that the dynamo-electric machine and its engine are more suitable than a series of gas retorts in this particular. The deficiency, however, was easily and speedily remedied in the instance of coal gas, but he would be a sanguine man who would venture to predict the same, or a like easy remedy, in the case of the electric fluid. Let inventors turn their attention in this direction, and a rich reward will await the success of their labors. When the power of storing and gradually distributing the electric fluid from this surplus store is proved to be possible, gas shareholders may begin to have some fear for the value of their investments; but until then, they may rest in tranquil possession of their property, so far, at least, as electricity is concerned.

I am content to rest the case of electricity *versus* gas there; the other matters, such as unlimited subdivision and regulation, important though they be, are, in my opinion, subsiduary to the great question of storage, and the failure to achieve these would not be a fatal obstacle to the very general use of electricity for illuminating purposes, provided the others were overcome.

In taking this common-sense view of matters, it will not be made a charge against gas managers and engineers that they are opposed to scientific progress in the shape of electrical or any other rival system of lighting. They are content to give a fair field to invention, and they ask no favor for themselves. What they desire to be known is that timid stock and shareholders are not to be taken as the exponents of their opinion on the subject. They are well able to appraise the value of their industry, which has become of sufficient importance to mankind at large, in more respects than one, to be insured against extinction under any circumstances save the exhaustion of our coalfields.

The agitation consequent upon the recent numerous displays of the electric light has had the effect, to a large extent, of putting a stop to necessary extensions in many gas works. This was perhaps a natural result under the circumstances. It is nevertheless to be regretted that advantage should not be taken, at a time like the present, when iron work of every

description is at a fabulously low price, and other materials and labor are comparatively cheap, to provide for the future heavy demand for gas that will inevitably ensue on a revival in trade.

To make extensions in a time of depression such as is now being experienced is desirable for several reasons. The extensions are executed with greater efficiency, because competition is stronger, and there is more time for deliberation. They provide employment for a numbers of workmen; and they are carried out at a smaller expenditure of capital than is possible under other circumstances.

I am not inclined to take the pessimist view of things that is entertained by some. Times of depression in trade are inevitable; they occur as naturally as the seasons. The majority of men, however, are not over prescient in their judgment. When trade is bad, they despair of its recovery; and when it is brisk and money is being made, they live in a fool's paradise, and speak and act as though the time of prosperity would never come to an end. Our own experience, and the record of the experience of others, should teach us a different lesson. If this country were alone in its depression there might be grounds for despair; but we know that such is not the case. Every country has suffered greatly, and in several that I could name the depression began long before its effects reached our shores. There are indications of returning confidence, both at home and abroad, and we may hopefully anticipate a gradual progress toward better days.

The question of street lighting has recently received more attention than had been previously bestowed upon it. Mr. Woodall, of the Phœnix, assisted by Mr. Sugg, has very opportunly demonstrated, in a practical manner, that with a more liberal consumption of gas, in suitable burners, an almost equal, and certainly a better diffused light than that furnished by electricity, and at a much less expenditure in money, can be obtained if desired.

The lighting of the streets is generally in the hands and under the control of the town authorities throughout the country, and it is a matter for surprise that they should not have attempted to remedy the inefficient lighting of which the public have at times so loudly and justly complained. In many foreign towns, as I know from experience, more attention is bestowed on this matter than at home; the lamps being placed nearer together, and the consumption per burner being greater, and this, too, notwithstanding that the cost of the gas is considerably higher.

I am enabled, by the kindness of Mr. Sugg, to exhibit to you to-day his latest improvements in gas burners and street lamps, as employed by Mr. Woodall in his demonstrations at Waterloo Place. The burners before you are adapted for a consumption of 15, 25, and 45, cubic feet of gas per hour each, and the light given, using London gas, is equivalent to 50, 100, and 200 standard sperm candles respectively. The same consumption of Manchester gas would yield a light equal to 56, 112, and 225 sperm candles, at a cost for gas per hour of about 1-2d., 9-10d., and 1 3-5d. respectively. The light, protected by a suitable lamp, is of the most beautiful and agreeable kind, and pleasing to the eye. The flame of the larger burner, viewed from a distance, resembles a massive globe of light. It produces none of that ghastly effect so characteristic of the electric light, and its diffusive power is greatly superior. Messrs. George Bray & Co., of Leeds, have also forwarded for inspection a number of their 80-candle power burners, and a variety of globes and burners for domestic and other lighting.

But now, gentlemen, let me put the very pertinent question, *cui bono?* What is the good of it all? Is it a fact that we really need or desire all this brilliant street illumination? Four months ago, at a meeting in this very room, I ventured to assert that it was unnecessary, and I am still of that opinion. That there is need for improvement in street lighting I have freely admitted. Let the local authorities see to it that such improved lighting as may be considered satisfactory is introduced; but, as we say here in our bluff north-country fashion, "there is a difference between scratching one's head and pulling the hair off." It would not be an agreeable thing to see the night turned into day, either by means of the electric light or by gas light, and I for one shall not advocate any such extravagance. It has been demonstrated that the thing can be done by gas lighting if desired, and at one-fith the cost of electricity (as proved by Mr. W. H. Bennett and Mr. Valon in their report on the recent 24 night's electric lighting at Westgate-on-Sea); but, as in our private affairs it is desirable to avoid parsimony on the one hand and wasteful luxury on the other, so in this matter of street lighting, let us practice the virtue that is found in the exercise of the same wise economy.

It is satisfactory to observe that the question of the economical consumption of gas is receiving attention on every hand. This awakened interest may be expected to lead to very important results. It is well known that by the use of imperfect and unsuitable burners, and a disregard of the regulation of the pressure, a proportion ranging as high as 50 per cent. of the light that gas is capable of affording may be, and often is, utterly lost in the consumption.

It grieves one to think, that, whilst the various bye-products of our gas manufactories are being utilized to the utmost, the gas, for the supply of which the manufactories were primarily called into existence, should be so prodigally wasted at the burner.

The gas manager has not hitherto been to blame for this undesirable state of things. His supervision has, as a rule, been supposed to end at the meter outlet. The internal arrangement and size of the fittings, and the description of burner employed, have been left to the combined wisdom, or ignorance, of the consumer and his gasfitter; and whilst freely admitting that there are intelligent gasfitters who are capable of advising their customers, and who possess a knowledge of the principles of illumination, it will not be disputed that the majority are utterly wanting in this knowledge. I have said that gas managers have not hitherto been greatly to blame; but if, under the altered circumstances of the times, they do not exert themselves to disseminate information on these points, within their respective districts, they will not be free from censure.

On the legislation of the past year, as affecting gas interests, there is but little to be said. The "Weights and Measures Act" of last session scarcely affects gas companies in these northern parts of the country. Coke is almost invariably sold by the cwt. and the ton; and the liquid products either by the gallon measure or the ton weight, and all that is required is to see that the weight or measure of the respective materials is what it professes to be.

I cannot let this opportunity pass without referring to the loss sustained by the gas world during the past year in the death of Mr. King, the Editor of the *Journal of Gas Lighting*. At the Annual Meetings of the parent Associations his kindly presence was familiar to all of us. A man of retiring habits, he was enthusiastic on all matters pertaining to our profession, and few men have worked harder and done more to promote the interests of its members. His loss to myself was that of a personal friend, and it was only in that capacity that his many and varied excellencies could be fully known and appreciated.

It is satisfactory to note, that, whilst the numerous district Gas Associations throughout the country are in a flourishing condition, and doing useful work, the parent Association maintains its high position, its annual meetings being looked forward to and prized for the superior opportunities they present of comparing notes and exchanging opinions with our brethren in every part of the United Kingdom. All this is indicative of a desire on the part of gas managers to acquire and to disseminate a scientific knowledge of their business; and it is a pleasing characteristic of these meetings that their own selfish interests have but rarely been the subject of discussion by the members; their duties and responsibilities, and how best to discharge these worthily, both to the authorities and the general public, occupying a foremost place in their proceedings.

The conviction is growing more strongly upon me, day by day, that, as the result of all this interchange of opinion in the various gas Associations, and the thoughtful attention that is being devoted by gas managers to the details of their business, that rapid strides will be made, and great improvements will be introduced in gas manufacture in the near future. In the presence of this growing intelligence, scientific methods of working must take the place of the clumsy operations that have so long held their ground amongst us. Difficult as the problem is to solve, I do not despair of seeing radical change effected in the mode of carbonizing. The system of heating retorts with gaseous fuel, with its attendant cleanliness and economy cannot fail to make progress now that there is awakened interest in the subject; and purification in closed vessels, by the use of certain of the very products that are eliminated as impurities, is all but accomplished, and requires only the master mind to conceive the best system of perfecting the process.

An interesting correspondence recently took place in the columns of the *Journal of Gas Lighting* on the important question—"The Education of the Gas Manager of the Future." The letters that appeared on the subject were very ably written. There can be no doubt that an actual working experience in youth, say from the age of 15 to 20, gives a man a positive advantage in after life as a manager; and if to his practical knowledge he adds that which may be gained by reading, and observation, and study, such a man will generally be found taking a foremost place in his profession. It is a fact that practice and theory act and react upon each other, and increase our knowledge far beyond the mere sum of the two. In other words a man who combines both theory and practice and is able to make the most of them, is worth half a dozen men of merely practical, or exclusively theoretical knowledge.

Without having absolutely taken part in the rough manual labor of gas works, the manager should possess a mastery of the details of his business, in all its various departments; and to enable him to acquire this mastery, he should have a quick eye for observation and discrimination. The habit of accurately observing is one that can be acquired, but to cultivate it thoroughly, the heart must be in the work. Whilst possessing the ability to direct his workmen, he must also, as the administrator of a valuable prop-

erty, be able to take a broad and thoughtful view of affairs. This is not compatible with burying one's head in a trench, so to speak, as I knew a manager of a large works to be in the habit of doing. He had a turn for main laying, and fancied that unless the work was principally done by himself it would be imperfectly performed. These and other cognate matters are best left, under proper supervision, to the practiced hand of the skilled workman.

Well, gentlemen, as this is the oldest, so let us each endeavor to make it the most useful, of the branch associations. We are situated in the centre of a wide and densely populated district, and the practical knowledge possessed by our members is, to say the leat, not inferior to that exhibited by the gas managers of any other division of the country. We have abundant opportunities for observation and comparison. and it should be our aim to excel in the management of our respective works.

For the gas manager who is ambitions to excel in his business there is no better mental exercise than preparing a paper to read at one of these meetings. The habit of thought and reflection that is engendered by committing our ideas to paper is of special value, and the benefit to the author is probably greater than to the listener.

I would say, therefore, to each member, but especially to the younger members of the Institution, put down in writing the result of your personal experience, and do not be deterred from introducing a subject, however hackneyed the subject may appear.

Let me just suggest a few topics on which papers might be prepared. The subject of "Carbonization" may be said to stand in the fore rank of our business. If the carbonization be satisfactory, the first step in successful working is accomplished, and in this connection it would be highly useful to hear what is to be said "On the Comparative Merits of Clay Retorts and Bench Ovens;" the results obtained by the use of each could be readily set forth by those having practical experience of their use. Then there is the difierent "Arrangements of Retort Settings, having in view the Equalization of the Heats and Economy in the use of Fuel." This is an important question, and worthy of repeated discussion. "The Mountings of the Retort Bench" would form an excellent subject for a paper, and it has the merit of novelty to recommend it. "Experience with Different Forms of Condensers." In the *Journal of Gas Lighting* for July 2, 1878, appeared a thoughtful article by Mr. Webber, on "The Proportions of Gas Condensers," in which the author discusses the scientific principles involved in this branch of purification, and endeavors, from an understanding of these, to determine the exact method of proportioning the apparatus. Again, in the *Journal* for July 23, there is a paper by Mr. W. P. Wilson, on improvements effected in the various forms of condensers. Both of these articles are well worthy of careful perusal and study, and doubtless they have attracted the attention of thoughtful gas managers. Condensation, important as it is, is still conducted in rather a haphazard fashion, and the apparatus employed in different works is of the most varied kind. We have the vertical and the horizontal forms of the apparatus, composed of large columns, and in many instances of pipes small in diameter; whilst some engineers are in favor of a single precipitating chamber of large area.

"The Various Kinds of Exhausters" might be treated of to advantage. Then there is the important subject of "Washing and Scrubbing Gas." and whether it is desirable that both processes should be adopted in the same works, and the advantages, if any, to be derived from combining the two. "The Materials used in Purifying, and their Manipulation." "The Storage Capacity for Gas that is Desirable in Manufacturing Towns." Here in the centre of a wide manufacturing district, our experience necessarily differs from that of managers in the non-manufacturing towns, and I apprehend that it would not be difficult to decide on the proper standard to adopt. "A Gas Manager's Winter Experiences" would give a few wrinkles worth remembering. "How to Reduce the Unaccounted for Gas" would embrace the subject of mains, service pipes, and meters, and is of second importance only to the work of the retort house. As bearing closely thereon, it would be interesting to have brought before us a statement of the progress that has been made both by Prof. Barff and Mr. Geo. Bower on their processes for the preservation of iron from corrosion. "The Management of Workmen" would elicit some hints that many of us might profit by. "How to Disseminate Imformation Among Consumers on the Best Mode of Burning Gas, so as to Develop the Maximum of Light it is Capable of Affording." "How to Increase the Day and Summer Consumption of Gas." The latter two are fast becoming the questions of the day with gas managers, as they include not only the question of light, but the correlative questions of motive power and heat for warming and cooking.

Several of our members have had much experience in the "Utilization of the Ammoniacal Residual of Gas Works," and a profitable afternoon could be spent in a consideration of the desirability of managers generally adding this source of revenue to their operations. As bearing upon this point, I may call attention to the article that appeared in the *Journal of Gas Lighting* a few weeks ago, written by F. W. Brothers, one of our members, describing and illustrating a method which, in conjunction with Mr. R. O. Paterson, he had discovered of utilizing the ammoniacal liquors in foreign works. In many places abroad the liquor is run to waste for want of the acid necessary to its conversion into the sulphate of ammonia; but by adopting the simple process described, a solid carbonate of ammonia is obtained, which can be packed in barrels, shipped to this country, and disposed of at a profit.

These are a few practical subjects which I commend to the attention of the members, and which might be profitably discussed at our meetings. The papers need not necessarily be long, so that they are to the point. In our growing experience, and in our daily observation as gas managers, we shall always find that much remains to be said on every detail of our business. There are many involved problems connected with gas manufacture that require discussion, and it would be an instructive paper, or series of papers, which would deal not only with what we think we know, but in regard to matters on which we are in doubt and difficulty.

We are to be favored with a paper today by Mr. Walter W. Hutchinson, "On the Various Apparatus used in determining the Amount of Sulphur Compounds in Coal Gas, and some of the Results Obtained." It is highly important to know the amount of impurity that still remains in the gas after it has passed through all the various stages of purification, because a clear knowledge on this head is essential to us in our attempts to reduce or eliminate it entirely, and we shall therefore listen with interest to Mr. Hutchinson's paper.

And now, to conclude, it is exactly ten years this month since the Manchester District Institution of Gas Engineers was formed. Such a period in the life of our institution is sufficient to justify the hope that it has at least emerged from its swaddling clothes, that it is established on a firm basis, and that it is an investment of good to its members. Let us all determine, that, so far as we are each personally concerned, the next decade of its existence shall be even more fruitful of advantage than the one that has passed away.

At the conclusion of the address a hearty and unanimous vote of thanks was awarded to the President.

[From London "Journal of Gas Lighting."]

More Light.

Two things have been abundantly made clear by the recent experiments in street illumination. In the first place, the inadequate, and, in some cases, perfectly dismal lighting of most of our public thoroughfares has been brought into prominent notice; and, secondly, it has been shown that whatever can be accomplished in the way of improvements by the use of the electric light, can be successfully rivalled, and even excelled, by a larger and more judicious use of coal gas. Unquestionably the electric light has been the cause of the demand for more light, but it is at present far from being proved that the employment of electricity is the best method of meeting such demand. Had the people recognized earlier the necessity for better street lighting, there can be no doubt that gas engineers would have had as little difficulty in supplying the want as they have had in lighting the Waterloo Bridge Road and Waterloo Place, Regent street, during the last fortnight. It is a little more difficult to account for the almost universal expression of satisfaction which has been pronounced, when the possibility of gas companies being superseded was contemplated. Such jubilation apparently proceeds either from prejudice or ignorance—probably both. The possessors of any form of monopoly will suffer more or less from unreasonable prejudice. Also, almost every household being familiar with the periodical gas bill, which is generally classed with other inevitable expenses—such as rent, taxes, and water rates—the gas companies are largely looked upon as the incarnation of a necessary evil, and their representatives receive about as much sympathy as tax collectors. The Vestries, in the matter of light, ever tender of the rate-payers pockets, have been in the habit of reducing the expenditure for street lighting to the lowest possible limit—a limit so low, in fact, that in some of our suburban roads it would make little practical difference if the gas lights were altogether extinguished.

If the rate-payers desire more light, they must, from whatever source it is obtained, be prepared to pay for it. But, apart from the question of cost, it can be conclusively shown that, of all the illuminating agents at our command, coal gas is the one which, in the most satisfactory manner, meets the exigencies of street lighting. The lighting of any thoroughfare, to be successful, must be uniform. It will not do to have sections of the road brilliantly illuminated (excepting were such is especially required), while other portions are left in deep shade or darkness; and hence the value of each lighting center must be judiciously proportioned to the dis-

tance intervening between light and light. Lights of very great intensity, except for busy spots and crossings, must be deprecated as wasteful. Now the combustion of coal gas can be made small or great, with this considerable advantage, that the proportionate illuminating power will remain practically constant. Thus, if 10 cubic feet of gas is burnt through a suitable burner, where previously we have only been burning 5 feet, we may rely upon getting double the amount of light in the former case. The application of this is obvious. If at any point in a series of lamps it is advisable to have an increased light, it is only necessary to increase at that point the consumption of gas. The lighting of the public streets might be increased to almost any extent; but the point must be determined when an amount of illumination is arrived at which will be sufficient for all practical purposes. No doubt, the greater the light the better the effect, and a road never looks so well lighted as when a large number of gas illuminations are burning; but such a result is a very extravagant and totally unnecessary one.

In determining the amount of illumination sufficient for all purposes, the circumstances of each case should be judged upon its merits. All roads do not require to be lighted to the same extent, nor even all parts of the same road. Wherever considerable traffic is carried on after dark, good lighting is a necessity, and it may be that such lighting would be a wasteful extravagance elsewhere. Also at the intersections of streets, at busy corners, and in such spaces as Piccadilly and Oxford Circuses, powerful centres of light would be of the greatest advantage. For an ordinary street or road, it will probably be found that a number of smaller lights closer together are to be preferred to fewer lights of greater brilliancy. The shorter the distance between light and light, the less loss of light takes place. Lights equal to 16 candles in illuminating power, placed 20 yards apart, are equal, in the general illumination of a thoroughfare, to lights of 25 candles place 25 yards apart. The height of any light from the ground, and the character of the lantern in which it is enclosed, are of no small importance. In most of the ordinary lamps the darkest part of the street is usually to be found immediately beneath the lamp pillar, owing to the dark shadows thrown downward by the framework of the lantern. This is readily obviated by changing its form, and it is remarkable that the present type of lamp-post and lantern should have survived so long.

The two experments with gas already referred to as now being carried on—the one in the Waterloo Bridge Road by the Phœnix Gas Company, under the direction of Mr. Woodall, their engineer, and the other in Waterloo Place, Regent Street, by the Gaslight and Coke Company, under the superintendence of Mr. Sugg, of Westminster—have caused the previous remarks to be written. These experiments differ in themselves, but are each eminently successful. The length of road lighted is the same in each case—viz., 500 yards. Previously to the recent alteration, the section of the Waterloo Road chosen—from the Bridge to the South Western Railway Company's terminus—was perhaps one of the most dismal specimens of street illumination that could well be found. There were twenty-two gas-lamps in all, including six at the intersection of the York Road; each of these gave a light, or was supposed to give a light of about twelve candles, or a total illuminating power of 264 candles. Sixteen of these lamps have now been replaced by forty-eight of the new ones, each fitted with a burner giving a light of fifteen candles—that is to say, the distance between light and light has been reduced one-third, the illuminating power, at the same time, being increased. The lamp columns have been reduced in height about two feet, and the old lanterns replaced by new ones, which are glazed at the top with opal glass. This transmits, as well as reflects, a large portion of the light, and at the same time abolishes, to a great extent, the usual shadow beneath the lamp. The six lamps previously at the York Road crossing have been replaced by two columns, placed, one in the centre of each of the two existing refuges, and each supporting a new form of lantern, octagonal in shape, enclosing large Argand burners, made by Mr. Sugg, the one giving a light of 130 candles, and the other of 200 candles. At the end of the road, next the bridge, the old posts being at distances 40 yards aparts, have not been removed, but have been fitted with Argand burners of 50-candle power each, and lights of similar value have been fixed at the four corners of the intersecting roads near the still larger lights. The idea has been to give, along the length of the road generally, an illustration of good lighting by ordinary lamps properly designed, and sufficiently near together, and at certain spots to concentrate the light where special brilliancy is an advantage. The effect produced is striking, as compared with the lighting of the other parts of the district, and the road has now at night the appearance of a well-to-do prosperous thoroughfare. As a rough test of the general illumination, it may be stated that an ordinary newspaper can be read in any part of the read.

With respect to the cost, Mr. Woodall furnishes the following figures:

The total cost, according to the old plan, was £93 10s. per annum, or 5¼d. per hour.

The New System.

Cost of lanterns, posts, burners, fixing, etc.				£120 0 0
Interest on first cost at 10 per cent.....	£ 12	0	0	
Cost of lighting, cleaning, repairing, etc., at 15s. per lamp per annum, the price paid to the Company.....	40	10	0	
	£ 52	10	0	

Gas—48 burners at 6 ft. per hour=288 feet
8 " " 15 " =120 "
2 " " 35 " = 70 "
Total 478 feet per hour, which, multiplied by 4200, the number of hours during which lamps are alight in the year, gives 2,007,600 cubic feet, which, at 3s. 4d. per 1000 feet, is... 334 12 0

Total per annum.....£387 2 0

Thus the cost of gas used in lighting a broad road, 500 yards long, amounts to 19d., and the total cost including maintenance to 22d. per hour. It is proposed, in the event of the continuance of such a scheme of illumination, to extinguish one-half the number of lamps at midnight, and this would reduce the cost to 14d. and 17d. respectively.

It will be seen, from the consideration of the above statement, that, by the new plan, the cost of such lighting is trebled, and it will probably be found that this represents about the minimum amount of improvement in street lighting which it would be advisable to attempt.

The second experiment of this nature, being carried out in Waterloo Place, Regent Street, is of a more lavish kind. Here the whole of the street lamps, 42 in number, have been crowned with a new form of lantern, hexagonal in shape, glazed, as in the previous case, with opal glass, and each lantern is fitted with Sugg's double-ring steatite Argand burners, consuming twenty cubic feet per hour, and giving a light equal to eighty standard candles. The refuge lamps in Piccadily are fitted with triple-ring burners, consuming twenty-three feet of gas per hour, and giving a light equal to one hundred candles. The two lanterns, one between the Athenæum and the United Service Club Houses, and the other before the County Fire Office, are fitted with still larger burners, each having four concentric steatite rings, and consuming forty-five cubic feet per hour, and giving the light of two hundred candles. A disadvantage in this experiment occurs from the necessity of using the old columns, which are somewhat too short for the new lights, and are placed irregularly upon the footways. This, of course, could be readily obviated if the lights are permrnently adopted. The statement of cost of gas furnished by Mr. Sugg is as follows:—

According to the previous arrangement, 105 cubic feet, at 4s. 4d. per 1,000, cost 5½d. per hour.

According to the present arrangement, 902 cubic feet, at 4s. 4d. per 1,000, cost 3s. 11d. per hour.

The gas used in Waterloo Place is cannel gas—that is, is equal to 20 standard candles when tested under the parliamentary conditions. A fact which is noticeable with regard to these larger burners of Mr. Sugg is that a greater proportionate increase in illuminating power is obtained by an increased consumption of gas. Thus the "London" standard argand burner gives, per cubic foot of gas consumed, an illuminating power of 3·2 candles; with the 50-candle burner this figure is raised to 3·4, and with the 100 and 200-candle burners respectively to 3·6 and 3·8. It need hardly be said that Waterloo Place is in this manner most brilliantly lighted—lighted, indeed, in such a manner as must satisfy the most skeptical as regards the possibilities of gas lighting. The fact has been shown, and those who run may read, that to obtain all that can by any means be deemed necessary, or even luxurious. in public illumination, there is no need to appeal to any other source than the various gas companies.

[From the "Gas Manager and Sanitary Engineer."]

Discontinuation of the Electric Light at Billingsgate Market.

Court of Common Council.

A meeting of this Court was held on Jan 30, in the Guildhall, under the presidency of Alderman Sir Wm. A. Rose, the Lord Mayor's *locum tenens*. Mr. Jex was desirous of learning whether it was intended by the Market Committee to continue the experiments with the electric light in Billingsgate Market, now that it had been proved detrimental and injurious to the business of the tenants, and prejudicial to the interests of the puplic and the Corporation. He likewise was desirous of knowing whether, on Jan. 28 and 29, the electric light did not go out, leaving the market in total darkness, and whether the tenants were not compelled to burn naphtha lamps in order to carry on their business, and that to the serious loss the salesmen.

Mr. Rudkin said, as chairman of the market committee, when the subject was under consideration, he might say that they had been trying to light Billingsgate Market with the electric apparatus. The committee thought, and hoped, that they should be able to do so successfully. So far as the mere light was concerned, it was amply sufficient for all purposes, but it so happened that at Billingsgate there were two or three elements which had to be considered. First, there was the question of warmth at this period of the year, and it appeared that the gas, which was consumed in very large quantities, imparted this, and did, in fact, warm the market. The salesmen, for this reason, practically preferred the gas to the electric light. The electric light also threw a comparative glare on the fish, and it was just possible that if they had the same description of ladies in the market now that they had fifty years ago—such as the *dames de marche*, or fishfags—they would raise the same objection as they heard was urged at the West-end of the town, viz., that the electric light might interfere with the complexions of the pretty "soles." (Laughter.) Be that as it might, he believed that the committee had come to the conclusion that, owing to the fact that the salesmen in Billingsgate Market—so long in the habit of selling fish by gas light—thought that the glare of the electric light was not satisfactory, and as their (the committee's) object was to give satisfaction to the salesmen and those using the market, they would do away with the electric light there. It would be clearly understood that it was placed there only by way of experiment, and the committee asked the salesmen to bear with them for two or three days, until they saw whether there was a possibility of the light being successful. It having failed, there was only one course open to the committee, which was to say that it should be discontinued.

[From the London "Journal of Gas Lighting."]

Midland Association of Gas Managers.

The annual general meeting of this Association was held on Thursday, Feb. 6, at the Midland Hotel, Birmingham, under the presidency of Mr. Charles Hunt, of that town. There was a good attendance of members.

The president delivered the following inaugural address:—

Gentlemen: The first year of our existence as an Association has been by no means uneventful as affecting gas interests. In the first place it will long be remembered as the year in which, with unaccustomed enterprise, the British Association of Gas Managers assembled in Paris, there to inspect methods of gas manufacture and distribution, differing in many respects from those with which its members were most familiar. Full of interest as was this investigation, and numberless as were the attractions of the "World's Fair," not the least cherished of the reminiscences of the visit are those which were furnished by the courtesy and hospitality with which the party were everywhere entertained.

We gas makers in England, rejoicing in an abundance of cheap material, and relying somewhat, it may be, upon the guardianship of paternal legislation, have for the most part been content to follow the beaten track, feeling satisfied if, year by year, some additional economy has been developed, some new vantage-ground gained in the war waged against waste. That this cautious policy has, in the main, been justified by results, there can be little doubt; for, after making all due allowance for varying circumstances, it will be found that nowhere, either on the Continent of Europe or on that of America, is gas supplied of a purer quality, or at a more reasonable price. But when on all sides are heard admissions of increasing excellence of foreign manufacture, and our manufacturers are lamenting, with ever-augmented bitterness, the keenness of foreign competition, it might well be that we too had fallen somewhat behind in the march of progress. In America has of late years been originated improvement after improvement in the art of telegraphy, while electricians on this side have confessedly stood still. France and Belgium are now able to boast, as the late Exhibition plainly showed, of engine factories capable of turning out work equal, if not superior to anything produced in this country. If this much can be said of competitive industries—if, notwithstanding the healthy stimulus created by friendly rivalry, our commercial supremacy has been hard to maintain, would it be deemed inexcusable in gas manufacturers, if, representing what is frequently termed, in accents of reproach, a monopoly, they too had suffered their neighbors to steal a march upon them? Whether this be the case or no, may form a not unprofitable subject for brief inquiry.

We were accompanied while in Paris by several American gas engineers of eminence, who, from an independent standpoint, were able to compare the relative merits of the systems prevailing in the two countries; and, for the purpose of self-examination, the impressions made upon their minds may be of value to ourselves. What these were is to be gathered from the report of an interesting discussion which followed the reading of a paper by Major G. Warren Dresser, on "The Gas Works of London," at a recent meeting of the American Gas Light Association, appearing in the American Gas Light Journal for Nov. 2d, 1878, and in the numbers of our own *Journal of Gas Lighting* for Dec. 10 and 17.

It is reassuring to know that, in many important particulars, the comparison is eminently favorable to the English works. As to our storing and distributing arrangements, no objection could be urged; while, to quote the words of one speaker, "the process by which hand power is saved, the coal distributed, and purification carried on, is such as to call forth the admiration of every one who sees it." But having regard to the fact that, after all, the retorts are the very heart of the concern, it is a matter of grave consequence to us to know that serious exception is taken to our method of managing them. The same speaker is reported to have expressed his surprise that "people who are so careful at the spigot are wasting so much at the bung." In other words, it is said of us that we do not get the proper amount of work out of our retorts, and that we do not obtain full value for the coals we put into them.

With this latter observation we may be disposed to agree, in the sense that all our operations show a deficiency as compared with the original weights of coals dealt with; but it is by no means clear that we are in this respect excelled by our neighbors. It so happens that the average production per ton is as nearly as possible the same, or about 10,300 cubic feet, in both capitals; but there is a considerable difference in the illuminating power of the two gases—that in London being for the most part about 16¼ candles, as vouched for by independent official examiners, while in Paris it is assuredly not more than 15. At the same time, the unaccounted-for gas in the former city averages only 7 per cent., whereas in Paris it amounts to nearly 10 per cent.; so that while in neither case is it likely that the measurement can be affected by imperfect condensation, it is least likely in that of our own capital.

With respect, however, to the capability of the retorts, it is probable that we have something yet to learn. At the Paris Gas Works, the retorts, which are D-shaped, 9 ft. 9 in. long by 25 in. by 14 in., and set in beds of seven, are charged every four hours, carbonizing during the 24 hours no less than 1760 lbs. of coal, and producing the large quantity of upwards of 8000 cubic feet per mouthpiece. This result, unequalled, as far as I am aware, in this country, is achieved with an expenditure of fuel varying from 25 to 29 per cent. of the coke produced, being much the same as our own. With us, however, as I need hardly say, the retorts are usually much smaller in sectional area, a size frequently met with being 21 inches by 14 inches by 10 feet to centre; and this, charged every six hours, is found capable of carbonizing about 1160 lbs. of coal, yielding 5400 cubic feet per 24 hours; so that a retort of the size employed in Paris might be expected to produce, if worked according to our method, 6400 cubic feet, still leaving 1600 feet in favor of the four-hour system. Now, what are the pecuniary advantages of the latter? As a matter of course, it cheapens the first cost of the retort-house, thus diminishing the subsequent charge for dividend upon that portion of the capital outlay. What this reduction is likely to amount to, per 1000 cubic feet manufactured, is easily determined. More often than not, the cost of a retort-house does not exceed £7000 per million cubic feet per diem manufacturing capacity; but let us assume that as much as £10,000 are expended. The annual dividend upon this, according to the present parliamentary maximum of 7 per cent., would be £700; so that upon the yearly output, which we should expect to be not less than 220 millions, the charge per 1000 cubic feet would be—

$$\frac{£700}{220{,}000} = 0{\cdot}76 \text{ of a penny,}$$

and the reduction to be effected by increased production would, therefore, be

$$0{\cdot}76 - \frac{6400 \times {\cdot}76}{8000} = \frac{16d.}{100} \text{ per 1000 cubic feet}$$

—a sum not, perhaps, large in itself, being almost inappreciable in its effect upon the cost of production, but of sufficient importance to arouse the economical susceptibilities of our friends, who discover in it one of the evil consequences of our English system of "protective legislation."

We should, however, expect to derive further benefit from an increased yield in the shape of a reduced wear-and-tear account. With us, the cost of renewals may be said to average about ½d. per 1000 cubic feet, the retorts being made to last variously from 20 to 30 months, the minimum duration being probably 600 days. On the other hand, in Paris, they renew their retorts after 12 or 14 months' work. They make their own retorts, and more excellent specimens of workmanship and material than were those of their manufacture at the Paris Exhibition, it would be almost impossible to produce. They were the admiration of us all. Nevertheless, they renew them at the end of 12 or 14 months—or, let us say, 420 days; so that the comparison (again allowing for difference in size) is between

8000 cubic feet × 420 days, or 3,360,000 cubic feet; and
6400 " × 600 " or 3,840,000 "

being 480,000 cubic feet, or as 8 to 7 of productive power, in favor of the London system.

[To be Continued.]

[Official Report.—Continued from page 106.]

THE NINTH ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held at Boston, Feb. 19, 1879.

Reports of the Secretary and Treasurer.

The President—Will you now give your attention to the reports of the secretary and treasurer for the past year?

The Secretary—The official report of the procedings of the Association, prepared by the secretary, has been duly published in the American Gas Light Journal. The President calls for a report from the secretary and treasurer. As secretary, I would report that, during the past year, the statistics of the various companies, who have made returns, have been tabulated, and the results have been put in very convenient form for distribution and for use; and I would also report that the secretary, under the direction of the committee on statistics, has sent to every member two copies of the table of statistics. In preparing these tables a great amount of labor was required; and if some mistakes have been made, I think that the members of the Association will pardon the members of the committee and the secretary—for there were a great many figures to be entered upon the table, and sometimes it was difficult to know from the returns exactly what the figures meant. Some were quite illegible, and some of the answers were made in a very equivocal way. But I think, upon the whole, that the undertaking has been a great success, and that the table of statistics will be of great benefit to the Association.

During the past year we held our semi-annual meeting at Hartford, and and we had a very interesting and pleasant meeting. It was peculiarly a social meeting, not a business meeting. We were handsomely entertained by Mr. Harbison, the Secretary of the Hartford Gas Light Company.

I think, for the past year, the secretary has nothing further of consequence to report. I will now present my annual report as treasurer.

TREASURER'S REPORT.

The following is a summary of the report:

Balance, as per last report	$ 108.08
Rec'd annual assessments, etc	265.00
" savings bank interest	38.42
Total	$ 411.50
Expended for sundry expenses	342.35
Balance on hand	$ 69.15

INVESTMENTS.

Deposit in savings banks	$ 1000.00
Interest accrued and added	60.16
Total	$ 1060.16

The President—Gentlemen; you hear the report of the Treasurer, which has been audited by the committee appointed by the board of directors last evening. What is your pleasure in regard to it?

On motion, it was voted that the report of the treasurer be accepted and placed on file.

The President—Is it the pleasure of the Association that we call the roll of members at the present time? I will say, furthermore, that the secretary has his clerk here to receive the annual dues which are now payable by the members.

The Secretary—By vote passed last year the fee of membership for new members for the first year is $5; for the succeeding years, until otherwise ordered, it is $3. That vote stands as the law of the Association to-day. The fee of membership for the old members, therefore, is $3.

The roll was then called, and the following members were found to be present, or were present at some time during the session:

William Yorke,	Portland	Gas Light	Company,	Maine.
Thos. A. Williams,	Bangor	"	"	"
John M. Hill,	Concord	"	"	N. H.
Chas. F. Warren,	Manchester	"	"	"
A. M. Norton,	Nashua	"	"	"
L. P. Kimpton,	St. Albans	"	"	Vt.
Wm. W. Greenough,	Boston	"	"	"
C. F. Spaulding,	Brookline	"	"	"
George D. Cabot,	Lawrence	"	"	"
O. E. Cushing,	Lowell	"	"	"
L. P. Gerould,	Newton & Watertown	"	"	"
Malcolm S. Greenough,	Boston	"	"	"
David Moore,	Salem	"	"	"
George Dwight,	Springfield	"	"	"
John Andrew,	Chelsea	"	"	"
Aaron Thompson,	Woburn	"	"	"
George B. Neal,	Charlestown	"	"	"
Thomas J. Pishon,	Roxbury	"	"	"
H. F. Coggshall,	Fitchburg	"	"	"
Edward Jones,	South Boston	"	"	"
David W. Crafts,	Northampton	"	"	"
Horace A. Allyn,	Cambridge	"	"	"
Charles D. Lamson,	Boston	"	"	"
William B. Durfee,	Fall River	"	"	"
Edwin Evans,	Lynn	"	"	"
Isaac R. Scott,	Waltham	"	"	"
J. F. Rogers,	Jamaica Plains	"	"	"
William Tarbell,	Waltham	"	"	"
Gideon Wood,	New Bedford	"	"	"
David Brayton,	Brockton	"	"	"
Dudley T. Tilton,	Newburyport	"	"	"
George L. Manchester,	East Hampton	"	"	"
C. W. Cochrane,	Gloucester	"	"	"
Edwin Keith,	Taunton	"	"	"
Charles S. Colbath,	North Attleboro,	"	"	"
W. K. Stratton,	Haverhill	"	"	"
J. H. Rollins,	Worcester	"	"	"
John H. Burnham,	East Boston	"	"	"
Milton Jewett,	Clinton	"	"	"
W. H. Frost,	Plymouth	"	"	"
George D. Bill,	Malden and Melrose	"	"	"
J. R. Todd,	Natick	"	"	"
James Armington,*	Providence	"	"	R. I.
Samuel G. Stiness,	Pawtucket	"	"	"
W. A. Stedman,	Newport	"	"	"
A. B. Slater,	Providence	"	"	"
Charles F. Smith,	Woonsocket, R. I.	"	"	"
F. C. Sherman,	New Haven	"	"	Conn.
Ogden Gilmor,	Norwich	"	"	"
Charles H. Nettleton,	Derby	"	"	"

Mr. Armington—I would like to inquire if there has been any arrangement made this year with regard to the report by the stenographer?

The President—There has been an arrangement made. I will state to the general convention that, at a meeting of the board of directors last evening, the same arrangement was made with the Editor of the American Gas Light Journal that was made last year; and that such portions of the report as may be approved by the President and secretary will be published, as an official record, in the American Gas Light Journal.

Mr. Armington—You refer, Mr. President, in the latter portion of your remarks, to a subject that I want to give some prominence to before this body. You say, "such of these proceedings as may be approved by the President and secretary shall be published." I don't know but I am satisfied with that; but I have this complaint to make. Last year we had a stenographer here reporting, and when the proceedings came to be published they were not published in full. Perhaps that was just as well. There were some things said that ought not to have been published. But there were some very pertinent things said, with regard to some processes, then new, that were entirely eliminated from our report, much to my displeasure, and that of those members with whom I talked on the subject—because it was the very kind of information that we wanted to lay before the public, and the very kind of information that we wanted the members to have before them to refer to at any time. Now, if the committee has been added to that shall take this thing in hand, that is satisfactory to me. But I do not want to see information, such as ought to have been spread upon the record, taken out of the report this year. My whole idea, in rising to speak upon the question, was to inquire if there was any such arrangement.

The Secretary—Being one of the committee to attend to that duty, I must say that there was a good deal said at the meeting referred to that I knew the members would not be willing to have go before the public—especially in relation to the mattter of statistics. But this year I hope we shall be able to publish everything. We had to strike out a good deal that we paid for last year. This year I hope it will all be reported and published in the Gas Light Journal. Some changes, perhaps, will require to be made; there may be some things said which members would not like to have repeated. But I think this year we shall be enabled to give a full report.

The President—Would it be the pleasure of the Association to give any instructions to the President and Secretary, or add to them, as a committee, other members of the Association, upon the matter of printing? I would say to the Association that there is much said here sometimes in a sort of conversational way, that the committee deemed it best, perhaps, not to encumber the pages of the Gas Light Journal with. There are other

*Original member. Now Engineer of Brooklyn Gas Light Co., Brooklyn, N. Y.

matters which, perhaps, as Mr. Armington has said, the members of the Association would have liked to have read in the paper. It is rather a delicate position for a committee to occupy, to decide what shall be printed and what shall not. I will say in behalf of the committee that they exercised their discretion, wise or unwise, and omitted certain portions.

Mr. Armington—I have no motion to make in regard to the question—only I think it should be distinctly understood. Of course, when we are sitting here and some badgering remark is made, we should be ashamed, perhaps, to see anything of that kind in the published report. But anything which relates to the management of the business which we come here to talk about, and which may be the means of furnishing a good many of us with information or arguments that we would like to use, such things ought not to be stricken out of the report, no matter who they hit, or whose process or patent they bear upon. If a man presents himself in your office with some plan which has already been shown up, and you do not wish to spend any more time about it, it is a very easy matter to refer him, for your opinion, to these very published reports. Those are the things which I did not wish to see omitted last year, and I hope they will not be stricken out this year.

The Secretary—I will state that everything that was authorized to be published by the committee was published in the AMERICAN GAS LIGHT JOURNAL. I have among the Secretary's papers the full report of the proceedings. If any gentleman wishes to look at them, just as they came from the hands of the stenographer, Mr. Gardiner, they can do so.

ELECTION OF NEW MEMBERS.

The President—Gentlemen; we have here the name of J. W. Averill, of Dover, N. H., presented for membership in the Association. He is recommended by the board of directors in the usual form. If there is no objection I will appoint Col. Spaulding to deposit the ballot of the Association upon the question of his election.

No objection being made, the ballot was deposited as above, and Mr. J. W Averill was declared unanimously elected a member of the Association, and was formally introduced by Mr. Geronld, of Newton, Mass.; and was welcomed to the Association by the President, with appropriate remarks.

OPENING ADDRESS OF THE PRESIDENT.

The President—Gentlemen; I am pleased today to welcome so many of our members to our annual meeting; and I feel that we should be grateful to a Divine Providence that has so kindly watched over us during the past year, and that we are enabled today, in health and strength, to meet once more in annual convention.

As is well known to you, gentlemen, the pressing duties of the past year, with the many trials which I have endured, and especially during the past few weeks, have prevented me entirely from taking any active part in making the arrangements for this annual meeting. I have been compelled to rely entirely upon the exertions of our worthy Secretary, who has most faithfully performed that part of his duty. I have been unable during the past year (which is always a source of great pleasure and profit to me) to visit individually the various works throughout the New England circuit. It has been a gratification to me in the past to visit those works, from the many acts of kindness, and the warm hand of friendship, with which I have been greeted. It has also been a source of profit to me, for I can say that there have been no works that I have ever entered from which I have not gone away feeling that I had learned something to be remembered.

Our semi annual meeting, which was held in Hartford, was one of marked pleasure. I think it was one of the most agreeable meetings that we have ever held; and the success of that meeting was due entirely, I may say, to the individual efforts of the resident member from Hartford; and I can truly say that, while it was one almost entirely of social enjoyment, it was also one of profit, and one which will be long remembered in our annals.

I do not feel today, gentlemen, competent to say more than a very few words. There has not been during the past year anything startling, or of marked importance in the history of our business. We may perhaps be upon the eve of some startling invention; but I think it is in the dim future yet, and I can only repeat today, what I said one year ago, that my faith is still in the good old-fashioned way of making gas from coal.

OFFICERS FOR THE ENSUING YEAR.

The President—The time has now arrived, gentlemen, for the appointment of a committee for the selection of officers for the ensuing year. I thank you most cordially for the high honor you have conferred upon me in twice elevating me to the highest office in your gift. I do, gentlemen, consider it an honor worthy of any man's ambition. I will appoint, as a committee on the selection of officers, Messrs. F. C. Sherman, of New Haven, Conn., O. E. Cushing, of Lowell, Mass., C. F. Spaulding, of Brookline, Mass., A. M. Norton, of Nashua, N. H., and D. W. Crafts, of Northampton, Mass. The committee will please retire and report the list of officers for the ensuing year.

The Secretary—Before that committee retires I wish to say a word. I have been honored with the election to the office of secretary for every year since the organization of this Association. I thank you heartily for the honor you have conferred upon me. I do not wish it to be understood, or you to think that I understand this to be a life position. I have held it a great many years; and if the Association think a change is advisable, I am ready to "step down and out." I wish the committee to understand, and the Association to understand, that the matter is entirely in their hands. If they wish me to serve longer, I am willing to do so. If they wish to put another in my place, I am willing to retire. The labors attendant upon this office are sometimes quite severe; but I make no charge for my services. I am willing to do what I can for the Association in this way without any reward, except the consciousness in my own breast that I am doing something for the benefit of its members. As you will notice in my report, the only expense chrrged for services last year was $10, and during that time a large amount of work was thrown upon the secretary in the preparation of the tables of statistics. I do not say this in a boasting way—that I have done a great deal for the Association. I did it because I liked to do it, and am willing to do as much more in the future. But I wish it to be understood by the committee that they are perfectly free, so far as I am concerned, to act upon the nomination of a secretary. I am willing, if they wish it and the Association sees fit to re-elect me, to remain and act as I have done, without any compensation; or I am willing to retire and leave the place for my successor.

THE ANNNAL DINNER.

The President—Gentlemen, there is one matter, perhaps, that might be discussed at this time. It has been the usual custom of the Association to have a dinner by themselves at a later hour in the after noon.

Mr. Dwight (Springfield)—I move that there be a committee appointed for the purpose of making arrangements with the landlord, that we may have our usual dinner. I think the hour heretofore has been five o'clock.

The committee as appointed by the Chair consisted of Messrs. Geo. Dwight, of Springfield, Mass., and Malcolm S. Greenough, of Boston.

A discussion took place at this point in regard to the place where the banquet should be held, at the conclusion of which it was voted that the dinner be held this year at the Tremont House, and the report of the foregoing committee in regard to the subject, stating the arrangements made with the proprietors of the hotel, be adopted.

REPORT OF THE NOMINATING COMMITTEE.

The President—The question is now upon the report of the committee to nominate officers. Please give your attention to the report of the chairman.

Mr. Sherman (New Haven)—The committee appointed to nominate a list of officers for the ensuing year have attended to the duty assigned to them, and beg leave to present the following names:

For President—Samuel G. Stiness.

For Vice-Presidents—L. P. Geroold and C. F. Spaulding.

For Directors—John M. Hill, Charles D. Lamson, J. P. Harbison, John Andrew, J. H. Rollins.

For Secretary and Treasurer—Geo. B. Neal.

A vote was taken upon the foregoing report, which was unanimously accepted, and the gentlemen named therein were elected to the several positions indicated, the ballot of the Association being cast by Mr. Sherman, who was empowered by unanimous vote so to do.

REMARKS OF THE PRESIDENT.

The President—Gentlemen: I have but one word to say in regard to the election with which you have favored me. I have said to my friends many times that I hoped that at the end of this year my term of office would expire. I feel to-day truly grateful for re-election to this honorable position. I appointed a committee the chairman of which so well knew my feelings that I supposed he would not have gone counter to them. Gentlemen, I accept the position with the most profound thanks; but while I can assure you that I will endeavor for the year to come to fulfill the duties of the office, I must rely upon you for your assistance in the future as I have done in the past, and I know that I shall receive the same support. But at the end of this year, under no circumstances can I accept a re-election, for I feel that the honors of this office should not be confined too long to one individual—that it should not be an office for life.

REPORT OF COMMITTEE ON STATISTICS.

The Secretary—The report of the committee on statistics has been called for. The chairman of the committee is Col. Stedman.

Mr. Stedman (Newport)—I suppose my report is part of the unfinished business of last year, as the committee acted in making up the questions for submission to the members as though it were a part of last year's business. I do not know whether we are considered as having entered upon our new year, or whether we still are finishing up the old business.

The Secretary—The record will give you that point better than my memory.

Mr. Stedman—My point is whether we have entered upon the business of the new year, or whether the officers of the new year were considered as installed. However, not to split the point too fine, I would say that the result of the labors of the committee has been placed before the members of the Association in a list of questions prepared and submitted for their answers. The answers have come in rather more slowly than was anticipated. It was the intention of the committee to have the answers tabulated and statements ready for distribution among the members at the present meeting. The questions were sent out early enough, so that the members might have their answers ready; and the time that has elapsed since the making up of the annual reports, on the first of January, has certainly afforded ample opportunity to prepare and furnish the answers to the questions asked by the committee. The questions have been, as members will notice, considerably extended. Nevertheless, questions which required several answers in the previous list, have been divided up so that each question requires only one answer to it. The committee are very sorry indeed that the answers have been delayed. There seems to have been a sort of feeling, expressed or implied, that the secrecy which was enjoined upon the members, and which was deemed to be an essential part of the confidence with which the members answered the ques-

tions has not been entirely maintained; although I have yet to learn of any evil results from anybody's knowledge of what we contributed towards the common stock of information. But as soon as possible after the lists of questions have been forwarded to the secretary (I believe about one-third of the whole number are still lacking), the answers will be tabulated and distributed to the members as was done last year. Additional precautions will be taken against any stray copies being furnished to parties who are not entitled to them. A very much smaller number of copies will be printed this year, and one copy sent to each member; the balance (except one or two copies to be retained in the secretary's office, like all other official papers, on file there) will be destroyed, after we are certain that the members have all received each the copy they are entitled to.

There is one question which I want to put to the Association, in regard to the tabulation of answers. There are certain deductions to be made by a careful consideration of the relation of the answers to each other, grouping companies with similar manufacturers and circumstances, as to the population and business of places in similar conditions; but I have here on this paper (not to read them all now, but to point out a few deductions that can be made) drawn off some averages, of which I will name a few, just to show the utility of them; and the committee would like, I think, to have the averages calculated, and put on the same table with the returns, so that the reference to them would be perfectly ready to every member of the Association. It is a matter requiring considerable figuring and calculation. It is a piece of work that can be done by one man in the same time that it would take seventy men to do the same thing, so that the omission to place these averages in the tables would be simply requiring each member of the Association to work them out for himself; and they probably would not be so thoroughly done as if required to be done once for all and printed, and, hence, a good deal of the benefit that might be derived from the study would be lost to the Association.

The President—I think if you will read some of the items and abstracts from that paper which you have, without giving the names of companies, it would be very interesting to the Association. It will take but a short time.

Mr. Stedman—For instance; the capital stock of each company per thousand feet of gas sold: the conditions under which the companies labor in that regard form rather a striking and interesting study. The company highest on the list has $30 of capital for every thousand feet sold—requiring of course, in order to pay a dividend of 10 per cent., $3 per thousand over the cost of the gas. The company lowest in the list has a capital of only $1.90 for each thousand feet of gas sold. The average of the companies is quite high—rather higher than the engineers would like to have it; because, while they can carefully economize in every direction (except in the reducing of their own salaries), the difficulty with capital is one that they cannot contend with at all, and the directors and stockholders do not seem very anxious to contend with it on their part. A great many companies figure up as high as $20 a thousand feet of gas sold, requiring the addition of $2, of course, to make their dividend of ten per cent. Only a small portion of the companies figure under $10 per thousand feet sold.

The consumption per capita of population, as indicating how gas is used in different towns, varies from 3,337 cubic feet per head per annum down to, I think, 200 cubic feet for the lowest. Then there is the consumption per meter, indicating how largely, of course the distribution of gas obtains among the population. In regard to the number of meters set, the highest meter consumption is 53,400 cubic feet for each meter set; the lowest is 6,560 cubic feet. The ratio of population to meters is another thing. Perhaps it only gratifies curiosity to look at it. The ratio is as low as 7 6-10 in one case; that is, there is a meter set in one community for every 7 6-10 inhabitants. It runs up as high as 60.

On the other hand the distribution per mile of mains is another instructive column, running up to 5,000,000, and a little over that in one case, and running down to 200,000 in another. The loss in each mile of main is another column, running from 400,000 cubic feet to 41,000 cubic feet per mile of main. Of course other columns might be added.

There was a question before the committee as to equalizing the size of mains in making returns; and a plan was proposed at one time requiring the answers to indicate the corresponding size—that is, requiring the answers to be based upon the area of a six-inch main all the way through. After consideration, however, in consultation with Mr. Slater, in perfecting the list of questions, it became evident that that was an unfair way of getting at it, since the loss on mains would be indicated more by the circumference of the main than by the area if the leaks were through the pores or through the joints in any way; and hence the reduction to one area would be unjust to those companies who had small mains, simply because the circumference would be directly as the diameters, whereas the areas would be as the squares of the diameters. As we thought that the question might not be thoroughly understood, and might make some confusion, it was omitted. If it be the pleasure of the Association, I should like to ascertain the feeling of the members present about that.

It would be a very small matter in the tabulation of statistics for this year to have these averages which I have indicated here and drawn off, compiled and printed with the tabulated returns that are sent to the members, and I think it would add a great deal to the usefulness of the tables that are returned to the Association.

There is no other question which the committee desired to draw the attention of the Association to at this time. If I have forgotten any, I hope the members will mention it.

The President—Does the chairman of the committee present the paper to the Association?

Mr. Stedman—I would be very glad to do so, although, unless it is copied or printed, it would be of no use now, because this relates to the returns of the previous year, and has no reference to this year's returns.

The Secretary—It had better go into the hands of the committee, to be sent out with the other.

Mr. Stedman—If the Association desires that this should be printed and distributed with the table of this year, as a separate thing from that table, of course I am perfectly willing that it should go in that way.

Mr. M. S. Greenough (Boston)—I move that Col. Stedman be invited to prepare a similar table, which may be printed with the table this year and sent to the members.

The President—You hear the motion of Mr. Greenough, that Mr. Stedman be requested to prepare a new tabulated statement, to be published with the new returns. Would you like to have this statement for the last year printed with that of the present year?

A Member—Since we are to get out a new table, we might as well have the whole thing new.

The President—The motion is that the chairman of the committee on statistics be requested to prepare a tabulated statement of the returns made this year, the same as was prepared the past year, and that they both be printed with the returns. What is the pleasure of the meeting? The question is upon printing the two statements, when prepared by the chairman of the committee.

The vote was taken upon the foregoing motion, as amended, and it was adopted.

The Secretary—In addition to what has been said by the chairman of the committee on statistics, as secretary I would make a further report: That I have here forty-six returns. There are sixty-four companies represented; of these there are several with two and sometimes with three elected from the same company. There are sixty-four returns which should be sent in. Of these, I have received forty-six. Eighteen are due. Of these returns many are complete and full. In some cases the questions have not been answered—sometimes one, two, and three questions and, on some of these returns, there are twenty or thirty questions unanswered. I think many of those not answered can be answered. Still I know that many superintendents of companies do not keep their books so that they can make answers to all the questions. It seems to me that this will incite them to do so—to put their books in better form so that they can make these returns for their own benefit and gratification. It is proposed, after the returns are all in, or as many in as we expect to receive, that the committee take them and look them all over, and if there are any answers they think ought to be made, that they will authorize or direct the secretary to send a communication to the party, who has not answered, asking him to complete his return. As these are to be published, it seems highly proper that every member should make just as full a return as he can. I do not know that it is necessary to read the names of those who have not replied, unless the Association wishes to hear them. At a meeting of the directors last evening it was voted that, when these tables are completed, one copy only be sent to each member making a return, and that a few copies more be kept by the secretary on file. It was also voted that all those copies now on hand of the past year's returns be destroyed, excepting one or two for the secretary to file away among his papers. The secretary was directed to keep the charge of these in his office, and that in the making up of returns none should see them except the secretary and the clerks in his office who will assist him in making them up, and, of course, the members of the committee. It is intended to keep them a little more away from the public observation than we did last year. There are sixty copies out now. Extra copies though may have been given around to other persons. We do not know where they are. This year I will assure those who make returns that they will not be seen, except by themselves, when the tables are sent out.

Mr. Wood (New Bedford)—Did I understand that only one copy would be sent to each company?

The Secretary—I suppose, taking the case of the New Bedford Company, that Mr. Taber, your president, would be entitled to one, as well as yourself.

Mr. Gerould—I would like to ask if Mr. Taber returned a statement? I believe the vote of the directors was that the statements should not be sent, except to those members who made a return. Did Mr. Taber make a return?

The Secretary—I think he did; but Mr. Wood may have done so.

Mr. Wood—I will answer the question, that it was made between us, in Mr. Taber's handwriting. I made the return mostly myself, and we would each like to have a copy of the document.

Mr. Gerould—Why, I ask, is that? I have some directors who would like a copy of those returns. I would like to have one.

Mr. Stedman—The Chair ruled that they were not members of the Association, and were not entitled to them. I think a later construction of the vote has been given—that where there were two members, the gas company, and also the member, were entitled to a copy, each member having a copy, and not only to the gas company. That has been the construction put by the secretary upon the vote—which I think was what was intended at the time the vote was passed.

Mr. Gerould—I do not consider that if there is a president of a gas company, or a treasurer of a gas company, who belongs to this Association, that he is entitled to a copy of these returns. They are only for the superintendents or engineers. I will say that there is Mr. Scott, who is a president of a gas company. I do not think he is entitled to a return—he does not make one.

The President—Does the Association wish to pass any vote in regard to the distribution of the returns after they have been tabulated by the committee, or will the same course be pursued as was pursued last year?

Mr. Cushing (Lowell)—I am a member of this Association, and I believe I am the only member from my company belonging to this body. Now I would say that, having made returns in previous years to this Association—having given my returns, according to my figures, the returns should be sent to me only.

The President—The intention of the Association is that the returns should be made to a member of the Association. If the gentlemen is the engineer of the Lowell works it is the intention of the Association that he, and he only, should be the recipient of these returns. If we have members of this Association, who are treasurers and agents of companies, and we have also members of the Association who are superintendents of the works, it has been the construction, which I consider would be the proper construction, that they each should be entitled to one copy. I regret that the returns to my friend Cushing have gone astray, and have got into other hands.

The Secretary—The return was directed to Mr. Cushing, and, before being sent, was checked off very carefully. If he has not got it, it is not my fault.

Mr. Stedman—I move that no copy be furnished to any person except to a member of this Association.

The President—It is fixed by the vote of the directors.

Mr. Gerould—I will move to amend that there be no returns made to any member unless he has himself filled out a return to this body.

The President—The amendment of Mr. Gerould is that no returns be sent to anyone except to the individual who signs his name to the return. That, of course, would deprive many of our worthy members from having the returns.

Mr. Dwight (Springfield)—I think that is hardly right. A gentleman may be a member of this Association of New England Gas Engineers, and not be connected with any gas company; and it seems to me that he should not be barred from the privileges of the Association merely because he is not an engineer of some gas company, after he has once become a member of this body. I think it should be confined to our members anyway.

Mr. Armington—I understand, then, that by this amendment Mr. Cushing will be ruled out altogether, and will not get any returns.

The President—No, sir; Mr. Cushing is a member of this Association. The amendment was not seconded.

Mr. Stedman—I would like to ask for a further construction of this order. Does it give to every member who refuses to make a return the same privilege that those have who make returns in good faith?

The President—There has been a previous vote (perhaps this would not supersede that), that no one shall receive the returns unless he makes a return himself. The supplemental vote limits it entirely. It gives a positive order to the secretary in regard to whom he shall deliver the returns. If the motion of Mr. Greenough should be adopted, it would make the restrictions more stringent.

Mr. Greenough—I will alter my motion so that it shall read: "That no returns shall be sent to any member from whom returns have not been received."

The Secretary—I will read the vote of last year: "That the secretary be authorized and directed to cause a suitable number of the tables of statistics to be printed and sent to each member of the Association except those who have made no returns, or, having made such returns, shall withdraw the same." You might alter it to read like this: "That the secretary be authorized to send one copy of the table of statistics to each member of the Association except to those who have made no returns, or, having made such returns, shall withdraw the same."

Mr. Gerould—I should think that covered my amendment entirely.

Mr. Armington—Now this matter is getting exceedingly complicated, and is liable to bring in a little bitterness with it, which I hope will be carefully avoided. If one company makes a return, and that company for its contribution gets the statistics of all the other companies, I should think that was entirely sufficient for that one company. Certainly every officer of that company—certainly all the members of the Association who were officers—have access to these returns. It is not necessary for the returns to be lying around loose in a great many different places. If the company wants to have a duplicate copy, *they could easily make one themselves.*

Now, in relation to the passage of this resolution. If we agree to give copies to all members except those who have not made returns, we complicate the matter exceedingly, because some members who may be here as representatives from the same companies, would not be entitled to returns; and there are others who, I think, are members of the Association (I am not sure about that, though, and I will not make the assertion), who are not connected directly with any gas company, who would be entitled to returns. If we limit it to only those who make returns, and give them one copy each, I do not see how that can work any hardship to anybody.

Mr. Cushing—I would like to understand, Mr. President, what is the object of this Association. I come here and pay my assessments every year, and I consider that I am entitled to all the privileges of this body.

Col. Armington (Brooklyn)—I think, Mr. President, that Mr. Cushing has got just the right idea about the question of *right* in this matter; but I should have a little delicacy about calling upon the secretary to furnish me with any reports that have been made by these companies, inasmuch as I have squarely declined to furnish any return of the company with which I am connected. I stated distinctly upon this floor why I refused, and I suppose that is generally understood. It was not proper for me to convey that information under all the existing circumstances under which we then labored; and those circumstances have not been brushed aside, consequently, I should still decline to make that return; and, as I say, I should feel great delicacy in asking to receive the returns from other companies on that account. But as a matter of *right*, sir, I think our friend, Mr. Cushing, stands squarely on the record. He comes here and pays his assessments, and is governed by the same laws as any other member; and, as far as the question of right is concerned, he is entitled to each and every paper that is presented here.

The President—The question is upon the adoption of Mr. Greenough's motion that but one copy be furnished to each member of this Association, and to no other person whatever.

Mr. Stedman—Does that override the previous resolution, read from the records, that no member refusing to make returns shall receive one?

The President—That is the intention of the mover.

Mr. Stedman—I take square issue with Col. Armington and Mr. Cushing in their logic on that question. I think a man who is a member of this Association does not conform to its rules and perform the duties devolving upon him when he simply pays his annual assessment. If we ask him to contribute his quota of information, for the general benefit, and he refuses to do so, I don't think he is entitled to those benefits. When we considered this question, and understood that we were to have tabulated statements, it was distinctly understood at that time that if a member refused to contribute his quota he was not entitled to the benefit of any of the information contributed by the other members. And it seems to me selfish in the extreme for a man to say, "Here, I will avail myself of the benefits of the Association in every way I can; but I will not contribute my quota at all;" and then to demand of the Association and say, "This is my right, and I insist upon it." No member is obliged to make any returns. We cannot compel him to do so. It is a voluntary acquiescence by the members in their contributions. Well, now, the returns are comparatively valueless if we are going to drop out one-third of our membership from them. I, for one, ask the liberty of withdrawing mine, I answered every question in full and to the best of my knowledge, and other members, I presume, have done the same in good faith. Why should they be called upon to spread the information they have given before others without receiving in return what they have a right to expect, and what they did expect in good faith when they sent their returns in. One or two returns have written upon the bottom of them, "We object to these returns being published unless there is a general acquiescence in making the returns on the part of all the members." I think quite a number would be withdrawn if it were known that members persisted in standing on their dignity and saying they would not make a return, but still insisting upon having the returns themselves, and assuming the benefits. Until the report becomes the property of the Association in that way, it is a mutual acquiescence of all the members in uncovering their records for the time being for the benefit of the other members. There may be those who are peculiarly situated, to whom, as Col. Armington says regarding his company, it would be very unjust, and, perhaps, injurious, to spread their records where access could be obtained to them by outside parties. If a company withholds the information, it is no more than fair that corresponding information should be withheld from it. It may be considered a question of right, I know; but it is not a question of equity.

Mr. Armington (Brooklyn)—I do not think we should be in a hurry about taking this vote. I am a kind of outsider; but I don't want to see any bitterness. I want to see the utmost harmony prevail, because it is only through harmony that we can expect to get at the ideas we desire. Mr. Stedman takes a square issue with this idea. He has a right to do so. I said that I should not, under any circumstances, apply to the secretary for those returns, not having made any. I think that covers his point with me. When you come to this matter of right, I understand a paper is presented and becomes the property of the Association by act of the secretary affixing his signature to it. Now, every member may come up here and say, "I have a right to look at that matter." He may be modest about it, and say, "I should like to have it, but I don't wish to be pertinacious about it." Still, if you attempt to deny to me my rights, I shall stand on my reserve rights, and say that I demand that there shall be no class legislation here at all. Whatever is brought here, or read for the consideration of the members, becomes the property of the members, provided any official vote is taken upon it. There may be just as many issues taken as you choose. It is only a year ago that my right almost to a seat in this body was denied, because I happened to live in Brooklyn. This is coming to the same thing. You would have to come to us and say, "Some of you are entitled to rights, and others are not." The instant you undertake to make that prevail, you will introduce the seeds of dissolution into this body.

The President—The question is upon the passage of the resolution. The chair wishes to allow the fullest discussion; but a good deal of time has been consumed. I think we should now proceed to take the vote. The motion of Mr. Greenough is that each member of the Association be allowed one copy of the tabulated statement as prepared by the committee. This overrides the previous vote of last year.

Mr. Allyn (Cambridge, Mass.)—I suppose that also covers gentlemen who have no connection with any particular gas company?

The President—They are not members.

Mr. Allyn—I believe we have such members, sir.

Mr. M S. Greenough—If these tables are paid for out of the funds of the Association, all members of the Association have a right to have a copy of them; and if they see fit to take these returns, making no returns themselves, that is a question for their own judgment as to whether it is a proper thing to do or not. But, unquestionably, I think they have a right to have them if they belong to this body. My motion was worded as it was, in order that Mr. W. W. Greenough, Mr. Lamson and myself might each have a copy of the returns; therefore, I framed the motion in this way. I will alter the motion again, so that it shall read: "That one copy be furnished to each member of this Association, and but one copy." As you read the vote it didn't bring out the point that I wished. I wish it understood that there shall be but one copy furnished to each member of this body.

Mr. Armington—Now, I want to know if the adoption of this motion makes it obligatory upon the secretary to furnish that copy, or is he simply to furnish it when called upon to do so?

The President—That is according to the amendment which Mr. Greenough has put upon it since the motion was discussed. It would appear to be obligatory upon the secretary by the amendment as Mr. Greenough has framed it.

Mr. Gerould—How many of those reports would be withdrawn under this vote? I fear a great many of them will.

The Secretary—I think there is one thing the gentlemen forget. These figures are the property of the several gas companies. If the directors of the companies represented here should vote that those returns should not be made, they could not be made.

They belong to the companies. Every figure that I make belongs to the Charlestown Gas Company, and if the directors should pass a vote that I should not make a return, I could not do it. We have been talking as if those returns were ours. Whose business do they relate to? It is the business of the Pawtucket Gas Light Company, the Charlestown Gas Light Company, the Lowell Gas Light Company, and of each of the other companies. We are simply superintendents or engineers managing their business. The returns are theirs, and they can restrain us from making returns relating to their business.

[To be continued.]

Gas for Domestic Use.

The following testimony as to the advantages of gas for domestic purposes by a London doctor appears in the *Journal of the Society of Arts:*

"Although I have always held that electricity, sooner or later, was destined to become the light of the future, still my faith in coal gas is so strong that I have doubled my stake in gas shares since the scare began. I have done so because I can see that coal gas is destined to become the cooking and heating power of the future. An arrangement of this kind would exercise an important influence on the domestic life of the community. With gas cooking, ladies could, without inconvenience, become expert cooks, and thus solve one of the greatest problems of our domestic economy. Again, as we should have no dusty and sooty grates to clean, we should be able to live with fewer domestics. Dr. Down informs me that at his great institution at Hampton Wick he does all his warming and cooking by gas, and although his gas bill is £500 a year, and gas 5s. per 1,000 cubic feet at Hampton Wick, he saves money by the use of gas in the place of coal, as he is enabled to do with propably six fewer servants. That warming and cooking by gas can, under the best management, be effected cheaper than by coal, many know from experience. If, then, this can be demonstrated, and our great gas companies will become domestic gas-fitters, and supply their customers with the best possible apparatus at the least possible price, not only will gas shares continue to be an excellent investment, but our domestic comforts will be greatly increased, our social position improved, and the great smoke of London may then become abolished. As it is calculated that two millions sterling a year of property is destroyed by the London smoke, we have, in this fact, an immense incentive to the substitution of gas for coal fires."

"GEORGE WYLD, M.D."

Petroleum and Lamps.

Certain recent proceedings in connection with the petroleum trade have a more than ordinary interest for our readers, inasmuch as they have afforded the means of making a series of useful and interesting comparisons between certain kinds of oil, wicks, and lamps. The chief, or, at all events, one of the principal features of the London meeting was the report of Mr. Redwood, who appears to have gone into the questions before him in a perfectly fair and unbiased manner.

Broadly speaking, it was ascertained that with certain burners and wicks it was found to be impossible to maintain flames of proper size and illuminating power even for a very brief period of time, whereas, when these burners were replaced by others with slightly wider wick tubes and with loosely woven American wicks, the same kind of oil burned well and satisfactorily to the very end of the supply of the illuminating material. At the same time there does not appear to be any decided advantage in the use of unnecessarily thick wick, the main requirement being that the cotton shall be loosely woven, and of good material. Mr. Redwood tells us that from his microscopic examination of some of the wicks used in this country he is able to state that, apart from their being tightly woven, the material is not throughout of a satisfactory nature—a fact which is of itself amply sufficient to account for much of the dissatisfaction which has recently been manifested.

On the other hand, we are told that the fault does not entirely rest with the wicks, but that some of the oils "burned reluctantly," even with the superior capillary attraction of loose cottons, and produced more charring and filming of the chimney than should occur with a good oil.

The evils complained of are thus shown, by careful and scientific evidence, to be anything but one-sided, and we therefore have no doubt that the trade generally will cordially endorse the resolution of the meeting, impressing upon the Standard Oil Company the absolute necessity of maintaining the highest possible quality both of ordinary and water-white oil shipped to the United Kingdom.

The feelings of the gentlemen at the meeting were well and appropriately expressed by Mr. James Hinks, when he said that they "had had to contend with prejudices against the general use of these lamp oils, but the lamps had improved from day to day, until they had arrived at an eminently satisfactory result, and their dismay at the proposed change might, therefore, easily be judged." Mr. Hinks seemed to entertain the idea that the proposed thickening of the cottons simply concealed an intention of sending over defective oils; but if any such deplorable backsliding was ever contemplated, we think it will be found to have been abandoned after the Standard Company has perused the speeches at the meeting.

The same gentleman hit the right nail squarely on the head when he advised the Americans to keep their oil up to its former standard, but that, whatever oils they may send, his firm, at all events, will be ready to make burners and wicks to burn them satistorily. Mr. Dowling warned the American producers that they did not take sufficient notice of coal oil competition, and gave instances in support of his contention, besides making the sensible remark that the poor man must have an oil that will burn without the application of chemical knowledge.—*Ironmonger.*

Cheap Gas—A Plea for Reduction by a Richmond Councilman.

Editors Dispatch: Gentlemen—In a recent number of your paper a communication appeared signed "Gas Consumer and Tax-Payer," calling on me to explain the proposed reduction in the price of gas. In reply I beg leave to state that at the last regular meeting of the Common Council I presented an ordinance reducing the price of gas to $2 per 1,000 feet. After some discussion the ordinance was referred to the joint committee on light and finance, where I hope it will receive a favorable and prompt consideration, and be reported back to the Common Council at its regular meeting in March. I am in favor of the reduction as contemplated in the ordinance I had the honor to present, because I believe it will be an advantage to the works by the increased number of consumers that will be gained thereby.

During the last fiscal year there has been a falling off of the consumers, so that on the last day of the fiscal year there were only 3,332 meters in use, as follows:

First district	822
Second "	1,384
Third "	1,126
Total	3,332 meters

while the general impression is that there are about 4,000 consumers.

I know that times have affected gas works as well as every other branch of industry in the country. During a visit to a western city last fall, the chief executive officer informed me that over 5,000 consumers had stopped taking gas, and were using oil as a substitute; and this falling-off has been attributed to the price charged for gas. In order to avert a similar result here, it is my purpose to do all in my power to have the price of gas reduced.

To understand this subject more fully, I herewith present the following statement of receipts and disbursements for the fiscal year ending Jan. 31, 1879:

Gas receipts		$150,674 12
Coke sold		9,690 89
Delinquent bills		861 89
Public consumption estimated at 20 million cu. ft., at $2.50 per thousand		50,000 00
		$211,226 90
Deduct—		
For payrolls	$67,318 97	
For expenses	8,185 65	
For coal	35,857 18	
		$111,361 80
Receipts in excess of expenditures		$ 99,865 10

which is over 13¼ per cent. on $750,000—a fair estimate of the present value of the works.

I submit that it is not fair to extract such a large percentage from 3,332 gas consumers, and I hope that a majority (if not all) the members of the Common Council and the Board of Aldermen will so consider it when the ordinance goes before them for their action.

The following is a fair estimate for the next fiscal year at $2 per 1,000 feet:

Gas receipts		$120,000 00
Public consumption		40,000 00
Coke		9,690 89
Delinquent bills		861 89
		$170,552 78
Less—		
Payroll	$63,000 00	
Coal	37,000 00	
Expenses	7,000 00	
		$107,000 00
In favor of the works		$63,552 78

or over 8½ per cent. on the estimated value stated above. In my opinion, everything ought to be done consistent with the best interest of the city, so that we may extend the use of gas thereby, which will be the most efficient means to prevent the use of oil, and thereby diminish fire-risks.

Respectfully,

JNO. M. HIGGINS.

—*Richmond Dispatch.*

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

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MONDAY, MARCH 17, 1879.

Official Report of Examinations of Gas for two Weeks ending March 8, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Feb. 1879.	Time of Day at which Test were made.	New York Gas-Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
24	Between 9.30 A.M. and 1 P.M.	16.90	17.38	18.05	16.54	16.62	
25		15.75	18.02	18.43	16.75	16.50	
26		16.03	17.40	18.63	16.67	16.44	
27		16.16	16.88	18.33	17.34	17.15	
28		13.56	17.24	18.51	16.92	16.76	
Mar. 1		15.87	17.35	18.44	16.88	16.58	
	Average	15.71	17.38	18.39	16.85	16.67	
3		16.76	17.80	19.03	16.32	16.33	
4		16.14	17.11	18.78	16.43	16.42	
5		16.04	17.28	18.85	16.75	16.23	
6		16.17	16.95	18.85	16.79	16.09	
7		15.98	16.46	19.06	16.74	16.26	
8		15.84	17.13	18.23	17.09	16.04	
	Average	16.15	17.12	18.80	16.68	16.23	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

Stickney, the Defaulter.—In the Superior Court this forenoon Judge Rockwell sentenced Chas. P. Stickney, the defaulting treasurer of the Manufacturers' Gas Company, of Fall River, to 5 years in the State Prison, with one day solitary confinement. He was remanded to the Taunton Jail to await the arrival of officers from Concord.—*Commercial Advertiser*, March 5th.

Correspondence

[We are not responsible for the opinions expressed by Correspondents. Correspondents, in all cases, should sign their communications with their names and address in full—not for publiction, unless desired, but as a guarantee of good faith.—ED.]

Correction.

In the letter from "Superintendent" that appeared in our last issue there was a mistake in stating the amount of capital stock, which should have read "62,500," instead of "625,000." This makes quite a difference in this case, and we regret that "putting in another zero" should have been our fault, and not that of the writer.

Purification and the Regeneration of Fouled Lime.

NEW YORK CITY, Feb. 20, 1879.

Mr. Editor: In these days of vigorous competition in the manufacture of gas, and the threatened advent of electric lighting, as a substitute for a large proportion of the former means of illumination, and the already large number of consumers using kerosene as a cheaper light, all enterprising gas companies are seeking every available means of improving the quality of their production, and, if possible, lessen the cost of it; and it seems to me incumbent upon every one possessed of any facts, tending to this end, to present them for the benefit of those most interested.

Of late, the subject of purification has occupied much of my time and attention, and I herewith present the results of my observations for your inspection and that of any of your readers who may feel an interest in this very important feature of the process of making gas.

As you are well aware, there are many forms of purification, of which the dry lime is the principal, and, for effectiveness and cheapness, undoubtedly the most desirable for those engaged in the distillation of coal, wood, etc., for their illuminating properties; but the great objection to it is the freedom with which it evolves the sulphur compounds, when exposed in a fouled condition to the air; and so numerous have been the complaints upon the subject that many companies are today using other forms of purification, seeking to avoid annoyance to their neighbors and patrons. Lime (CaO) in the form of hydrate of lime (CaOHO) has apparently a powerful affinity for the offensive impurities contained in gases, yet from its easy evolution of them, when exposed to the air, would suggest that it was more of a mechanical combination of these impurities with the lime, than a chemical union of same, and this may be illustrated in an exceedingly simple manner; any one who has been in the immediate vicinity of a purifier recently opened for the removal of the fouled material, and the replacing with new, will remember the odor of their clothing; the sulphur compounds having entered the pores of same, so freely was the fouled lime expelling its load—after being in the air for a time, or in another room at a higher temperature, this odor would depart, proving that the gases were mechanically held by the clothing. The usual discoloration of the lime in a fouled state ought to tend to contradict this assertion; but this change of color is produced by the action of the sulphur compounds upon the iron, which exists in all lime to a greater or less degree.

Then, aside from this objection to lime is the difficulty of storing it, especially in crowded cities—the least wind scattering the fine powder over everything. And then the value of the store room is a serious item in many localities, while the proceeds from the sale of spent lime do not effect any material reduction in the cost of the gas.

These objectionable features of the lime process have been overcome in many localities by the substitution of other materials possessing none of these annoying features. Lime has been used in the dry state since first introduced by Mr. Clegg, in the year 1805, and several plans for ventilating the effete material have been suggested and tried, but, as far as I have been enabled to inform myself, the ventilating processes exist more in theory than in practice. By reference to Mr. Clegg's most valuable work upon Coal Gas Manufacture, the subject of purification is found to be treated in an elaborate and thorough manner. Herein he has given almost every form of material substituted for the lime, and some of them have proven most effective, both as possessing the power to chemically combine with all the offensive impurities, and thus avoid any disagreeable odors, and sufficiently economical to be within the reach of all companies.

Probably the best purifying material used as a substitute for the lime processes is composed of a mixture of the native sesquioxide of iron (FE_2O_4), commonly known as the hematite ore, with enough granulated sawdust to produce the greatest extension of surface, as well as porosity in the mass, and frequently sprinkled with a solution of the sulphate of iron in water. This material possesses a strong chemical affinity for sulphuretted hydrogen (H_2S) and ammonia (NH_4)—the sesquioxide of iron combining with the former, and the sulphuric acid of the sulphate of iron, with the latter. The material when in a fouled condition, upon exposure to the air undergoes rapid oxidation, the oxygen of the air uniting with the iron of the sulphide of iron, leaving the sulphur in the mass as free sulphur. Of course some little sulphur will undergo oxidation as well, producing a small amount of sulphurous acid and sulphuric acid, and these will unite with a portion of the iron. The whole being reduced when the mixture is used the second time. The ammonia having united with the sulphuric acid of the sulphate of iron, forming the sulphate of ammonia, without any odor or further change.

These iron mixtures, while possessing such a strong affinity for sulphuretted hydrogen and ammonia, have none for carbonic acid, which is a serious destroyer of light, for its presence in gas materially interferes with the combustion of the light giving hydrocarbons, resulting in a very dull and red light, the gas possessing a very small proportion of the illumination it would if free from carbonic acid, about 1 per cent. of which will destroy the gas to the extent of one candle, and 10 per cent. will render the gas incombustible.

This destruction of light means a loss in a pecuniary sense as well. The entire removal of these objectionable elements from gas may be effected by a thorough working of a double system of purification: first passing the gas through a series of purifiers containing an iron mixture, and removing the sulphuretted hydrogen, and thence through a series containing the hydrate of lime, for the removal of the carbonic acid. This is accomplished by many of the English gas companies, and I believe the only American company using the system is the New York Mutual Gas Light Company, they having two sets of purifiers for the iron process, and one set for the lime process, and the results are eminently satisfactory. Mr. Clegg's work, page 191, states:—

"The use of lime, subsequently to that of oxide of iron, for the purpose of removing the carbonic acid, ought never to be omitted."

When the saving in illumination, by the use of the double system, is considered, I think any intelligent gas manufacturer will admit that it is the most economical and satisfactory of all the processes of purification, to say nothing of the absence of all offensive odors. Every one conversant with gas making knows how impossible it is to avoid the generation of a greater or less quantity of carbonic acid, for a leaky retort or imperfect joint is liable to exist at any time, in the very best constructed and managed establishment, and all gas makers know the result; and, then, the dryest coals known possess sufficient latent moisture to produce considerable of this objectionable

element. In this country we have an inexhaustible quantity of coal which is comparatively free from sulphur, and by using an iron mixture for its removal, the quantity of sulphur being so small, the depreciation in the purifying material is exceedingly slow, and the work accomplished at a minimum of cost. The iron mixture described hereinbefore is the form in use at the New York Mutual Gas Light Company's Works, and has yielded over 34,000 cubic feet per bushel of material used, for here this record is kept as well as for the lime process. We know that these iron mixtures, when fouled, can be revivified and used again and again, until it becomes necessary to remove the free sulphur, which is accomplished by heat, afterwards adding new material to compensate for the material shrinkage attending this operation. The regeneration resulting from the removal of the free sulphur from the iron material is extensively done in England with profit; but as yet, in this country, so few are using other than the lime process that there is not enough of the material to induce any of our manufacturing chemists to undertake it, and it is deposited with all other refuse; but the day must come when this work will be extensively done in this country. The revivification of the iron mixtures is a very simple operation, as all using them can testify, and if the fouled lime could also be revivified, and used again and again, the subject of purification would be most complete, and leave nothing to be desired.

I am aware that many attempts to regenerate fouled lime have been made in other countries, and with approximate success in several instances, but the parties did not claim a positive reclamation of the waste material, owing to the absence of chemical analysis; and the manner in which they treated the lime was in as fine a state of division as possible, and as lime in a powdered state is an excellent non-conductor of heat, I do not think the heat could reach and act upon every particle alike; hence much of the lime thus treated would still be in the form of carbonate of lime. Some tried reburning it in the form of bricks or blocks, but abandoned the plan because they thought the heat would not act upon the material in the heart of these lime forms.

The regeneration of fouled lime, in both of the above forms, is discussed in an article copied into your journal of June 3, 1878, from an English or Scotch journal. The regeneration or reburning of lime has been successfully accomplished in this country, and with a degree of success both surprising and gratifying to the parties engaged therein. Early in the year 1878 Dr. A. W. Wilkinson, chemist of the New York Mutual Gas Light Company, began his experiments, and the first attempt was a grand success. It occurred to him that if crude lime, in the form of lime stone, or rock, or oyster shells, could be placed in an ordinary kiln and thoroughly calcined, and rendered caustic lime, when the heat was sufficient to do the burning perfectly, why could not powdered lime be made into forms and treated in a like manner? Certainly it was only a matter of heat, and in placing them in a close kiln, the draught could be easily provided for by piling the material—if the forms could be made to bear the weight of those piled upon them without crumbling. He accordingly secured the use of a brick machine and a close kiln, and then several samples of lime, some of which were impregnated with sulphuretted hydrogen and ammonia, and others simply in the form of carbonate of lime. The lime was slightly moistened and then made into good-sized bricks or blocks and laid in the kiln in rows, piled one above the other, with a space between the rows for ample draught. Heat was applied slowly at first, until the excess of moisture was driven out, after which the heat was increased, and after a certain number of hours the presence of carbonic oxide was observed in the main flue, just outside of the kiln wall. At this time he knew the heat was acting upon the lime throughout. The firing was continued as strong as possible until the carbonic oxide disappeared, when he decided that the kiln was ready to cool and the material be removed. The material, when perfectly cool, was slaked, and not only was every particle of the lime thoroughly calcined, but it came out of the slaking box as white as chalk—whereas some of the samples originally were almost as well loaded with tar as with the other impurities.

Upon examination of the lime, before slaking, it showed innumerable white specks throughout, and these were found to be that part of the original limestone or oyster shells which the first application of heat had not reached, and the second burning had calcined every particle. The shrinkage of the mass in burning it was about 25% of its original bulk; but upon slaking every bushel of caustic lime produced two and one-eighth bushels of hydrate of lime. So successful were these experiment that patents were secured in this country and in England, and the New York Mutual Gas Light Company immediately availed itself of this great improvement. Two kilns, with a total capacity of 2,500 to 3,000 bushels, and all the necessary apparatus for manufacturing the bricks or blocks were erected, and operations commenced early in September, 1878, since which time the reburning of spent lime has continued unceasingly, and with great success, something over 70,000 bushels having been handled in this manner to February 1st, 1879. All the developments in the experiment having been realized on the larger scale of working, and it is found that the regenerated lime does about one-third more work than any purchased from the manufacturers: and the cost of reburning, including the labor of placing it again in the purifiers, is less than half the price of new lime. The new lime costing the New York Mutual Gas Light Company six cents per bushel, delivered at their works, while the regenerated article, including every expense, costs less than three cents per bushel. In reburning the lime all the offensive impurities are consumed in the kiln, owing to their all being combustible gases, and no odor whatever can escape into the atmosphere. It is the quick application of a burning heat, after the excess of moisture in the material is expelled, which decomposes the remaining moisture and carbon of the burning gases into carbonic oxide, which effects a calcination of every particle of lime. Gas companies can keep in store just the quantity of lime necessary to their working, and reburn it as often as desired.

The depreciation is not appreciable in reburning carbonate of lime, and in that impregnated with sulphuretted hydrogen and ammonia; the formation of sulphide of calcium is only about one per cent. for every reburning—the heat simply driving out impurities mechanically held with a slight chemical union.

I have endeavored to treat the subject presented intelligently to all, and, if I have succeeded, I shall feel repaid for the effort.

Respectfully, yours,

E. S. T. Kennedy.

Carrying Coals to Newcastle.

Iron Ore from Algiers.

"The British iron steamship Derwentwater arrived at Perth Amboy, N. J., on Monday last, from Boda, Algiers, with a cargo of 1,400 tons of Mediterranean iron ore. The cargo was consigned to Bowring & Archibald, of Pearl street, for use at the Bethlehem, Penn., Iron Works; and it is the first vessel of a fleet of steamers which will bring ore and other products from the Mediterranean and Spanish ports to Perth Amboy. The steamers will return with grain and provisions."—New York *Tribune*, Feb. 27.

This importation of iron ore from Algeria is nothing new for the Bethlehem Iron and Steel Works, but the establishment of a direct line of steamers for the importation of iron ore for the use of one of our largest steel and iron establishments has sufficient significance to call forth remarks from the *Mining Record*. Our iron and steel manufacturers have received vital aid from Congress. In giving that aid it was supposed, assuredly, that they would work essentially upon indigenous material. Our great industrial establishments, such as the Bethlehem Iron and Steel Works, are bound to make the most thorough experiments with the ores of this country, and to guard against any hasty judgment upon the unfitness of American ores for their use, as this company seems to have done—blindly, as we believe, to its own true interests, present as well as future. That there is not an abundance of ore in the United States quite as well suited as the Algerian for the purposes of the Bethlehem works, we cannot believe; and we have reason to know, further, that the managers of the company, while profiting by legislation friendly to their industry, have hastily acted upon the erroneous idea that it could not find a proper character of iron ore in this country whose real opulence in that character of mineral is almost illimitable. Those who go to Congress for substantial aid to their industry are under no slight obligation to use the natural products of the country in that industry. That any one of our iron and steel companies, upon any true industrial principle, is obliged to resort to Algieria for the iron ore it uses we do not and cannot believe for a moment. Neither can we believe that Congress has so repeatedly and materially favored our iron industry with the expectation that the iron and steel manfacturer should go abroad for his ore.—*Mining Record.*

Friction.

Prof. Thurston read a paper recently before the American Association for the Advancement of Science, entitled "Friction and its Laws, Determined by Recent Experiments." He quoted the generally accepted law of friction, as stated in the text-books, as follows:

"The resistance offered by friction, where two bodies, forced into contact, slide one upon the other, is directly proportional to the pressure, and is independent of the area of the rubbing surface, and of the velocity of rubbing." This law, the professor said, although approximately correct for sliding one upon another, provided no abrasion takes place, is quite incorrect beyond that limit. It is also entirely incorrect as applied to lubricated surfaces. In this case the resistance follows an entirely different law.

Where two rubbing surfaces are lubricated with oil it is obvious that, from their being separated by a thin fluid film, the resistance to the relative motion is not due entirely, even if at all, to friction of solids, but must be produced by the resistance of fluid to molecular disturbance, since, with good lubrication, the solids are kept apart and out of contact with each other, by an interposed film. It is therefore evident that the resistance to motion must follow a law intermediate between that governing the friction of solids and of fluid friction—approaching the latter more closely as the lubrication is more perfect and the separation of the solids is more complete. Under such circumstances, two limits may be noted to the law governing resistance under ordinary circumstances.

1. When the pressure is made excessive the unguent is forced out, and the solids come in contact abrasion occurs, producing a sudden and great increase of resistance.

2. When the pressure is diminished, a limit is finally reached, at which the resistance to motion is due to the viscosity of the unguent, and this is still effective, even when the rubbing parts are relieved of all pressure.

The law of variation of resistance is, then, that of fluid friction merely. Speaking of friction with varying motions, the writer said Prof. Ewing had suggested that there probably existed a law of increase of friction with decrease of velocity, which holds good throughout the whole range of velocities down to zero of motion, when the coefficient of friction of motion changes, by a continuity of variation, into that for starting from rest. The writer, however, found the change from one condition to the other to occur very

suddenly, and at all ordinary speeds, at the instant of coming to rest; and the friction at the instant of stopping is always much below that of starting, although greatly in excess of that for motion at all speeds in ordinary work. A great variety of tables were submitted, illustrating the amount of friction under various conditions. It was shown that the variation of pressure produces a very great change in frictional resistance, as measured by the coefficient. A diagram of a machine devised by the writor was shown, with which it was attempted to secure means of placing the lubricant under precisely the same conditions of actual service, and at the same time to provide facilities for observing its behavior, and of obtaining exact data.

The machine here mentioned is valuable for testing lubricants, in which spurious mixtures, such as cotton seed oil, have caused many fires in factories. The conclusions generally have a practical bearing on fires arising in factories from friction.—*Am. Exch. and Review.*

Quantitative Analysis of White Light.

It has for a long time been a problem waiting for experimental decision, to determine accurately the relative intensity of light in the different parts of the solar spectrum. The prism splits up a ray of sunlight into its component parts, the colors it analyzes, qualitatively, but the question to do it quantatatively is an open one, as since Newton no definite inquiries have been made, but only estimates which usually stated that in the yellow light there was the greatest quantity, and in the violet the least. Prof. Rood of Columbia College, New York, has recently taken the subject up, and first tried to ascertain the dividing line between the neighboring colors, attempting, for instance, to determine definitely where red ceases and orange begins, and so for all the colors. Prof. Rood thinks that definite standards of color cannot be denied, and that artists agree in this, but if we consider the very gradual shading of the spectrum so that the colors blend imperceptibly one in the other, and remember the fact that the impression of color is subjective and not objective, that means depends greatly upon the individual who judges about the colors, it is evident that the determination of the limits must differ in the individuals, and Prof. Rood's determination of the limits would be more reliable and subject to verification if he had taken as his limits certain spectral lines, of which there are enough to serve any purpose of division. Having divided the spectrum into 12 parts, he multiplied the space occupied by each part, with the relative intensity or luminosity, when he obtained the following results: red, 54; orange red, 140; pure orange, 80; orange yellow, 114; yellow, 54; greenish yellow, 206; yellowish green, 121; green and blue green, 134; Prussian blue, 32; blue, 40; ultramarine bluish violet, 20; pure violet, 5.

The result of these investigations proved that the amount of light in the "warm colors" (as painters call them) is nearly three times as great as it is in the "cold colors," which are those of a blue and green shade.—*Manuf. and Builder.*

PROPOSALS.

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March 17, 1879.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked.
Gas Co.'s of N. Y. City.				
Central	466,000	50	60	75
Harlem	1,800,000	50	30	50
" Bonds	170,000			103
Manhattan	4,000,000	50	190	195
Metropolitan	2,500,000	100	115	122
" Scrip	$1,000,000		99	103
Mutual	5,000,000	100	70	75
" Bonds, gold	900,000	1000	95	99
Municipal	1,500,000	100	115	125
" Bonds	750,000		95	100
New York	4,000,000	100	95	100
Nothern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	135	145
Citizens	1,200,000	20	67	75
" Scrip	320,000	1000	90	95
Peoples	1,000,000	10	20	30
" Bonds	325,000			95
" Scrip	300,000		75	80
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	70	75
" Ctfs.	700,000	1000	90	95
Williamsburgh	1,000,000	50	85	90
" Scrip			90	95
Kings Co	300,000	100	—	70
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000		60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	10
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100		80
Citizens, Newark	918,000	50	90	95
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			128	13
Cincinnati G. & C. Co.				190
Derby of Conn	160,000	100	60	80
East Boston, Mass		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind		100		—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	120	125
Hempstead, L. I	25,000	100		—
Jersey City	386,000	20	140	145
Jamaica, L. I	25,000	100		—
Jacksonville, Ill	120,000	50	82	
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	—	
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch		20	30	40
New Haven, Conn		25	136	152
Peoples, Jersey City			—	80
" " Bds.				95
Peoples of Albany	650,000	100	10	17
" Bonds	350,000	1000	—	
Peoples of Baltimore		25	44	48
" Bonds			106	—
Plainfield, N. J	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Toledo, Ohio			95	97
Washington, D. C		20	—	200
Yonkers		50	70	80
Woonsocket, R. I	150,000	100	80	
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Pittsfield, Mass			120	130
Rondout & Kingston			75	80
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens	600,000	100	—	60
San Francisco Gas-Co., S. Fr'isco Cal.			95	95¼

The following actual sales of gas stocks were made at auction March 12, 1879:

250 shares of Brooklyn, N. Y., @ 140; 116 shares of Nassau, Brooklyn, N. Y., @ 70–71; 58 Williamsburgh, Brooklyn, N. Y., @ 86; $937.50 scrip of same company, @ 93; 47 shares Metropolitan, New York city, @ 121; $315 scrip, same company, @ 102; 25 shares Manhattan, New York city, @ 192.

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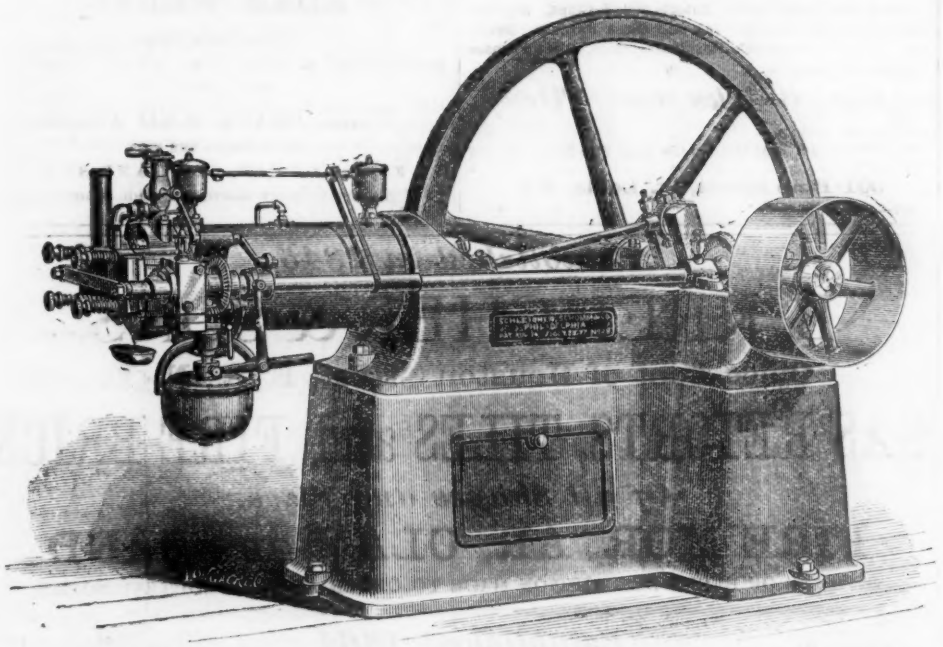

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Newcastle	3.75 @ 3.85	
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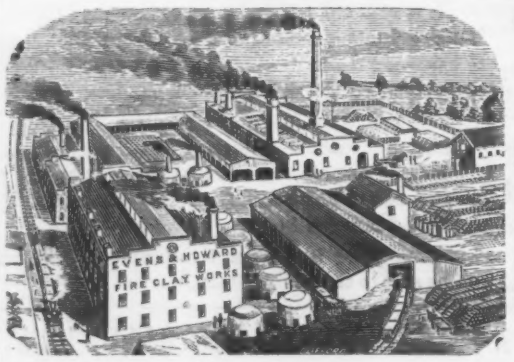

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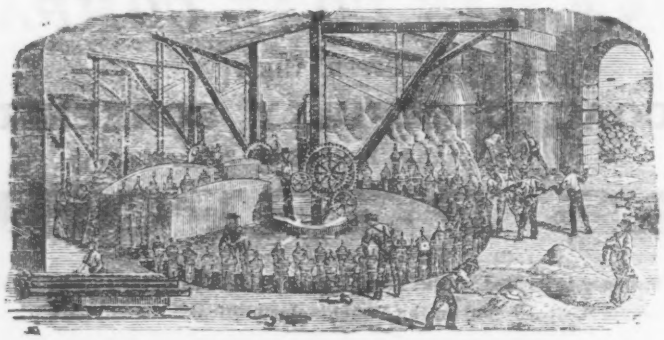

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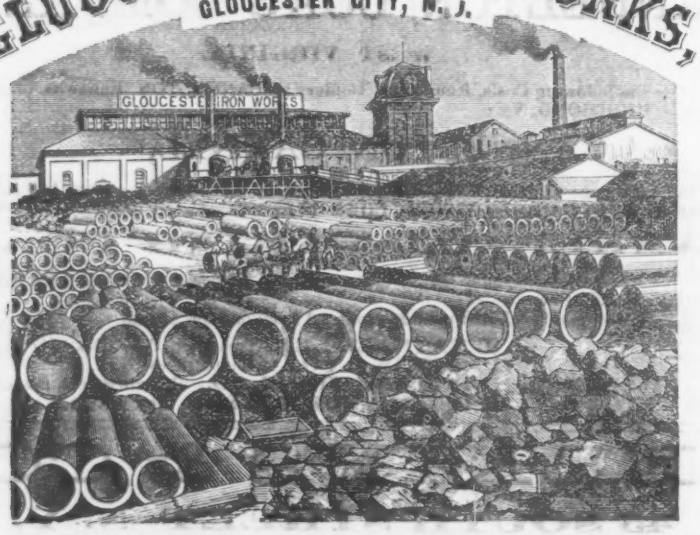

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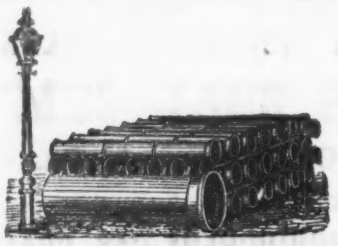

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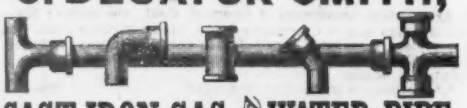

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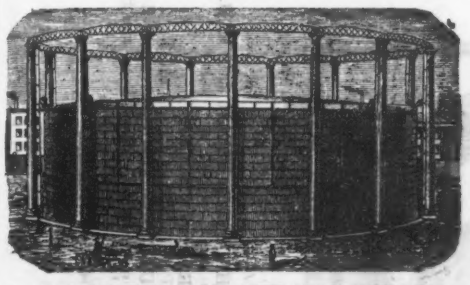

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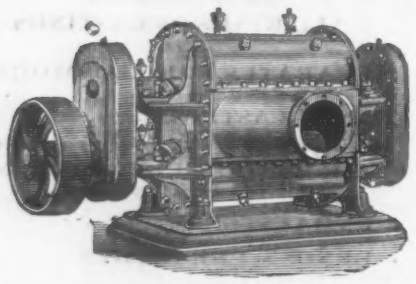

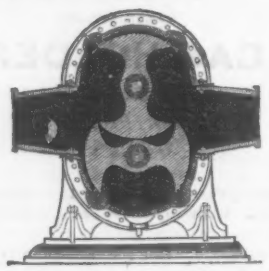

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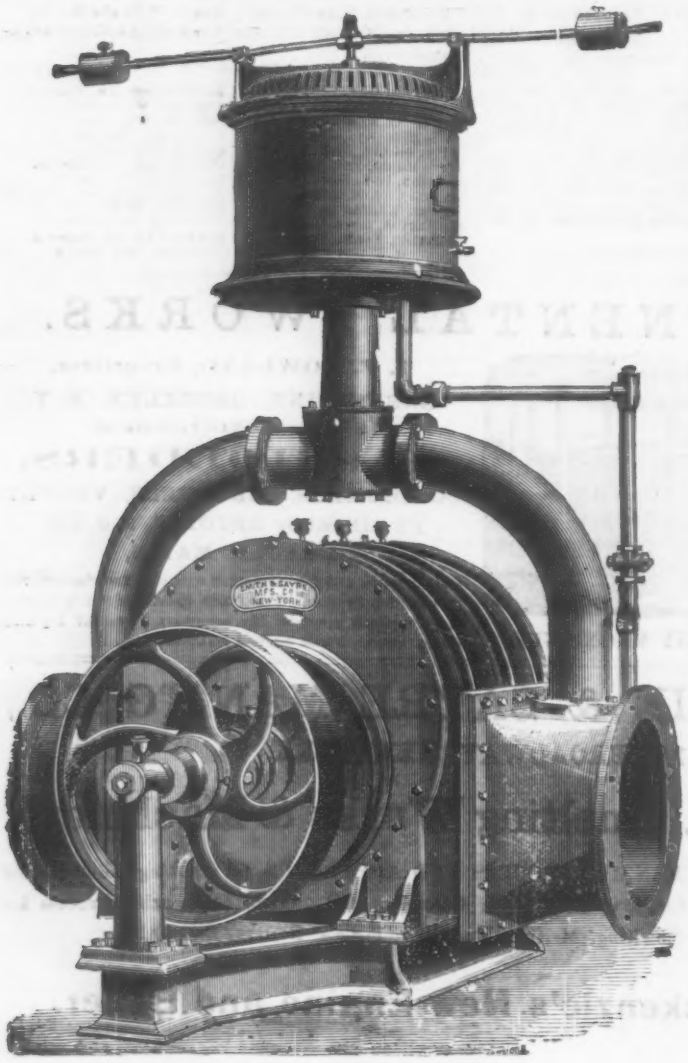

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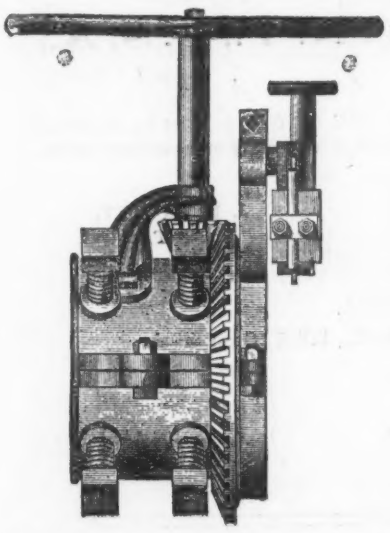

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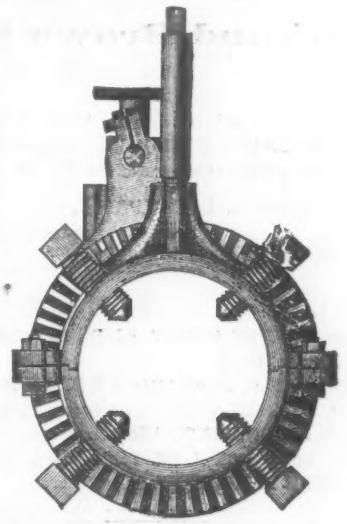

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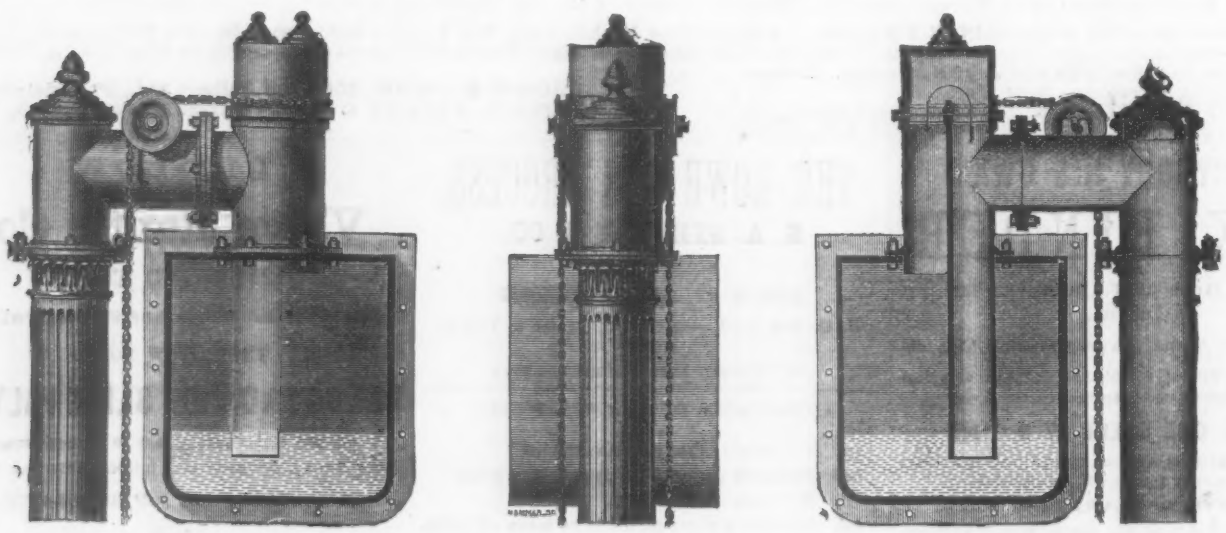

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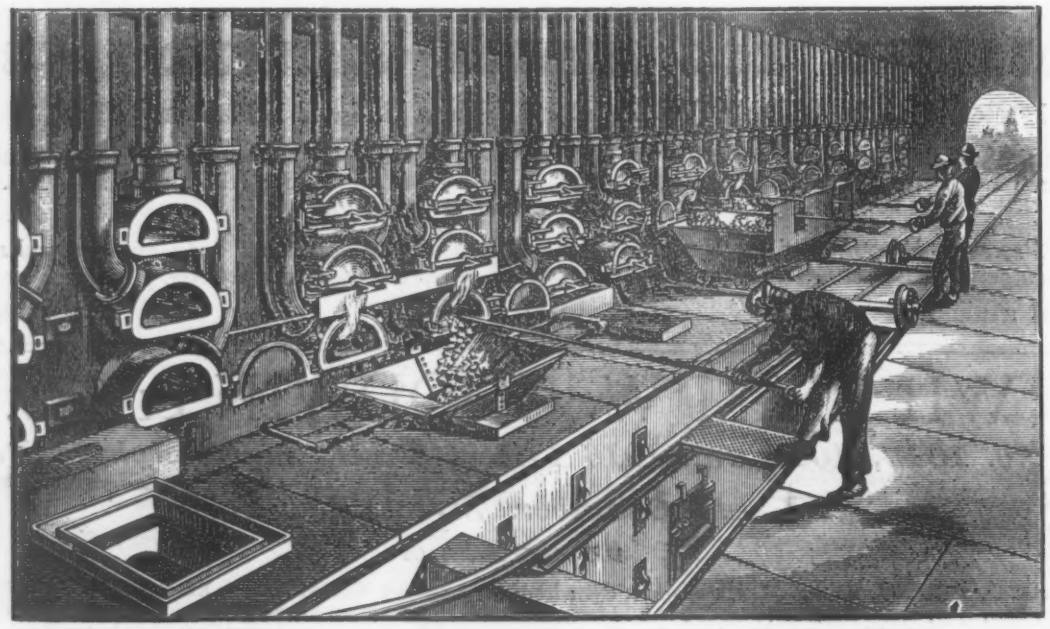
FOR HEATING BENCHES OF RETORTS.

CAN BE ADAPTED TO ANY BENCH WITHOUT DISTURBING THE ORDINARY SETTINGS.



These Furnaces have been in operation at the works of the People's Gas Company, Baltimore, since June, 1878, and all the benches in use at the present time at the above works are heated by this system, **WHICH EFFECTS A SAVING OF 33 PER CENT. IN THE NUMBER OF RETORTS REQUIRED** for making a given quantity of gas per day.

A charge which ordinarily requires four hours **IS THOROUGHLY BURNED OFF IN THREE HOURS**, and the amount of coke used does not exceed **33** per cent. of coke made.

The patentee is now prepared to furnish plans, detailed drawings, and full directions for construction to those desiring to purchase. For full particulars apply to either

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